MONITOR Contents

TABLES

Preface

Intended Audience

This manual is intended for VAX/VMS system managers, operators, and system programmers.

Structure of This Document

This document is composed of six major sections.

The Format Section is an overview of MONITOR and is intended as a quick reference guide. The format summary describes the DCL command that invokes MONITOR, listing all qualifiers and class-name parameters. The usage summary explains how to invoke and exit from MONITOR, how to direct output, and any restrictions of which you should be aware.

The Description Section explains how to use MONITOR.

The Command Qualifiers Section describes each command qualifier. Qualifiers appear in alphabetical order.

The Commands Section describes each MONITOR command. Commands appear in alphabetical order.

The Examples Section contains examples of common operations that you perform with MONITOR.

The Supplemental Information Section describes MONITOR recording file record formats.

Associated Documents

For additional information on the topics covered in this document, refer to the *VAX/VMS DCL Dictionary* and the *VAX/VMS System Manager's Reference Manual*.

Conventions Used in This Document

Convention	Meaning
RET	A symbol with a one- to six-character abbreviation indicates that you press a key on the terminal, for example, RET .
CTRL/x	The phrase CTRL/x indicates that you must press the key labeled CTRL while you simultaneously press another key, for example, CTRL/C, CTRL/Y, CTRL/O. In examples, this control key sequence is shown as ^x, for example, ^C, ^Y, ^O, because that is how the system echoes control key sequences.
$ SHOW TIME 05-MAY-1986 11:55:22	Command examples show in black letters all output lines or prompting characters that the system prints or displays. All user-entered commands are shown in red letters.
$ TYPE MYFILE.DAT . . .	Vertical series of periods, or ellipsis, means either that not all the data that the system would display in response to the particular command is shown or that not all the data a user would enter is shown.
file-spec,...	Horizontal ellipsis indicates that additional parameters, values, or information can be entered.
[logical-name]	Square brackets indicate that the enclosed item is optional. (Square brackets are not, however, optional in the syntax of a directory name in a file specification or in the syntax of a substring specification in an assignment statement.)
quotation marks apostrophes	The term quotation marks is used to refer to double quotation marks (″). The term apostrophe (′) is used to refer to a single quotation mark.

New and Changed Features

Version 4.4 of the Monitor Utility includes the following new functions:

- A new CLUSTER class[1] that permits live display and recording of significant clusterwide performance data for up to 16 member systems. Two screen formats are available.
- A new CONVERT command that converts to Version 4.4 format recording files produced with previous MONITOR versions.
- A new /NODE command qualifier[1] that allows users to request performance data for any or all classes for up to 16 VAXcluster member systems.
- The I/O Request Queue Length item of the DISK class is now sampled every second regardless of the collection interval value. This change yields queue length statistics with a consistently low sampling error.

[1] Requires that DECnet–VAX be installed.

MONITOR

The Monitor Utility (MONITOR) is a system management tool that enables you to obtain information on operating system performance.

FORMAT

MONITOR *[classname[,...]]*

Command Qualifiers	Defaults
/BEGINNING=time	*(See Command Qualifiers Section.)*
/[NO]BY_NODE	*NOBY_NODE*
/[NO]COMMENT="string"	*NOCOMMENT*
/[NO]DISPLAY[=file-spec]	*DISPLAY*
/ENDING=time	*(See Command Qualifiers Section.)*
/FLUSH_INTERVAL=seconds	*(See Command Qualifiers Section.)*
/[NO]INPUT[=(file-spec,...)]	*NOINPUT*
/INTERVAL=seconds	*(See Command Qualifiers Section.)*
/NODE=(nodename,...)	*None.*
/OUTPUT=file-spec	*None.*
/[NO]RECORD[=file-spec]	*NORECORD*
/[NO]SUMMARY[=file-spec]	*NOSUMMARY*
/VIEWING_TIME=seconds	*(See Command Qualifiers Section.)*

Command Parameter

classname[,...]

Specifies the class(es) of performance data to be monitored. To monitor all classes, specify the ALL_CLASSES parameter. When you specify several specific classes, separate the class-name parameters with commas or plus signs. Note that the ALL_CLASSES and CLUSTER class names are mutually exclusive. Note also that cluster monitoring functions require that DECnet–VAX be installed.

You must specify one or more of the following parameters:

ALL_CLASSES	Statistics for all classes
CLUSTER	Clusterwide performance statistics
DECNET	DECnet–VAX statistics
DISK	Disk I/O statistics
DLOCK	Distributed lock management statistics
FCP	File control primitive statistics
FILE_SYSTEM_CACHE	File system cache statistics
IO	System I/O statistics
LOCK	Lock management statistics
MODES	Time spent in each of the processor modes
PAGE	Page management statistics
POOL	Statistics on space allocation in the nonpaged dynamic pool
PROCESSES	Statistics on all processes
SCS	System communications services statistics
STATES	Number of processes in each of the scheduler states
SYSTEM	Summary of statistics from other classes

MONITOR class names accept a variety of qualifiers, as summarized in Table MON–1 in the Description Section. Complete descriptions of qualifiers for each class are provided in the Commands Section.

usage summary

Invoking

To invoke MONITOR, issue the DCL command MONITOR. The utility then displays the following prompt:

```
MONITOR>
```

In response to the prompt, you can issue any utility command.

Note that you can also initiate MONITOR requests from command level by issuing the DCL command MONITOR along with the desired qualifiers and parameters. However, in terms of system overhead, it is preferable to initiate requests in response to the MONITOR> prompt.

Exiting

Generally, each MONITOR request runs until the time specified or implied by the /ENDING qualifier. However, you can press CTRL/C or CTRL/Z to terminate a MONITOR request earlier. Pressing CTRL/C terminates the current request without exiting from the utility. You can then initiate a new request or issue any Monitor Utility command. Pressing CTRL/Z terminates the current request and exits from MONITOR.

Directing Output

Information collected by MONITOR is normally displayed as ASCII screen images. You can use the optional /DISPLAY qualifier to specify a disk file to contain the information. If you omit the file specification, output is directed to SYS$OUTPUT. See the Command Qualifiers Section for a discussion of the /DISPLAY qualifier.

Privileges/Restrictions
No privileges are needed to invoke MONITOR.

monitor commands

Syntax
MONITOR> command

MONITOR Commands
CONVERT file-spec
EXECUTE (@) file-spec
EXIT
HELP [command]
INITIALIZE
MONITOR classname[,...]
SET DEFAULT classname[,...]
SHOW DEFAULT

DESCRIPTION

The Monitor Utility permits you to monitor classes of systemwide performance data (such as system I/O statistics, page management statistics, and time spent in each of the processor modes) at specifiable intervals and to produce a variety of outputs. MONITOR collects system performance data by class and produces three forms of optional output:

1 A disk recording file in binary format

2 Statistical terminal displays

3 A disk file containing statistical summary information in ASCII format

The utility initiates a single MONITOR request for the classes of performance data specified each time you issue a command of the form

```
MONITOR [/qualifier[,...]] classname[,...] [/qualifier[,...]]
```

Regardless of the order in which you specify class-name parameters, MONITOR always executes requests in the following sequence:

PROCESSES
STATES
MODES
PAGE
IO
FCP
POOL
LOCK
DECNET
FILE_SYSTEM_CACHE
DISK
DLOCK
SCS
SYSTEM

Depending on the command qualifiers specified, MONITOR collects system performance data from the running system or plays back data recorded previously in a recording file. When you play back data, you can display it, summarize it, and even rerecord it to reduce the amount of data in the recording file. The Examples Section illustrates these operations in greater detail.

For additional information on how to interpret the information the Monitor Utility provides, see the *Guide to VAX/VMS Performance Management*.

1 Class Types

Each MONITOR class consists of various data items that, taken together, provide a statistical measure of a particular system performance category. The data items defined for individual classes are listed in the description of the MONITOR command in the Commands Section.

There are two MONITOR class types, differentiated by the scope of the data items collected:

- *System Classes*, in which the data items provide, for the entire system, statistics on resource utilization (CLUSTER, DECNET, DLOCK, FCP, FILE_SYSTEM_CACHE, IO, LOCK, MODES, PAGE, POOL, STATES, SYSTEM).
- *Component Classes*, in which the data items provide statistics on the contribution of individual components to the overall system or VAXcluster measure. These classes are DISK, PROCESSES, and SCS (system communication services).

As an example of the distinction between MONITOR class types, the IO class includes a data item to measure all direct I/O operations for the entire system. The DISK class, on the other hand, measures direct I/O operations for individual disks.

2 Class-Name Qualifiers

The class-name qualifiers control the type of display and summary output format generated for each class name specified. They have no effect on the recording of binary data. Each of these qualifiers applies only to the immediately preceding class name. Class-name qualifiers must not appear as part of the command verb. Table MON–1 summarizes class-name qualifiers and defaults.

Table MON–1 MONITOR Class-Name Qualifiers

Class Name	Qualifiers	Defaults
ALL_CLASSES	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	See Commands Section
CLUSTER	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/CURRENT
DECNET	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
DISK	/ALL /AVERAGE /CURRENT /ITEM /MAXIMUM /MINIMUM /[NO]PERCENT	/ALL /ITEM=OPERATION_RATE /NOPERCENT
DLOCK	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
FCP	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL

Table MON–1 (Cont.) MONITOR Class-Name Qualifiers

Class Name	Qualifiers	Defaults
FILE_SYSTEM_CACHE	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
IO	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
LOCK	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
MODES	/ALL /AVERAGE /[NO]CPU /CURRENT /MAXIMUM /MINIMUM /[NO]PERCENT	/CPU /CURRENT /NOPERCENT
PAGE	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
POOL	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/ALL
PROCESSES	/TOPBIO /TOPCPU /TOPDIO /TOPFAULT	None
SCS	/ALL /AVERAGE /CURRENT /ITEM /MAXIMUM /MINIMUM /[NO]PERCENT	/ALL /ITEM=KB_MAP /NOPERCENT
STATES	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM /[NO]PERCENT	/CURRENT /NOPERCENT
SYSTEM	/ALL /AVERAGE /CURRENT /MAXIMUM /MINIMUM	/CURRENT

The class-name qualifiers fall into three categories:

1. Statistics qualifiers (/ALL, /AVERAGE, /CURRENT, /MAXIMUM, and /MINIMUM) specify which statistics appear in display and summary output. These are conflicting qualifiers; specify no more than one of them with each class name in a MONITOR request. Note that statistics qualifiers cannot be used with the PROCESSES class name or for multifile summaries.
2. The data transformation qualifier (/[NO]PERCENT) controls whether data for the selected class name is expressed as percentages of a whole. This qualifier can be used only with the STATES, DISK, MODES, and SCS class names, and it is not allowed for multifile summaries.
3. Class-specific qualifiers (/CPU, /ITEM, /TOPBIO, /TOPCPU, /TOPDIO, and /TOPFAULT) control the output of a specific class.
   - The /CPU qualifier is used specifically with the MODES class name to list CPU information for VAX–11/782 attached processor configurations (except for multifile summaries).
   - The /ITEM qualifier is used with the component statistics class names DISK and SCS to specify one or more data items for inclusion in display or summary output.
   - The /TOP qualifiers are used with the PROCESSES class name to produce bar-graphs showing the top processes, instead of the standard summary and display output. Top processes are the heaviest consumers of the resource being monitored. Up to eight processes can be shown in each display. Note that the /TOP qualifiers are mutually exclusive. Specify no more than one of them in a single request.

3 Outputs

The Monitor Utility can produce any combination of three forms of output for any single MONITOR request. The forms are display output, recording file output, and summary output. Output forms are specified with the /DISPLAY, /RECORD, and /SUMMARY qualifiers.

- /DISPLAY produces output in the form of ASCII screen images. Screen images are written at a frequency governed by the /VIEWING_TIME qualifier.
- /RECORD produces a binary recording file containing data collected for requested classes; one record for each class is written per interval.
- /SUMMARY produces an ASCII file containing summary statistics for all requested classes over the duration of the MONITOR request.

If you specify /INPUT with any of these qualifiers, MONITOR collects performance data from one or more previously created recording files; otherwise, data is collected from counters and data structures on the running system. The MONITOR request begins and ends at times specified by the /BEGINNING and /ENDING qualifiers, respectively.

3.1 Display Output

Display output consists of a series of terminal screen images. One screen image per requested class per requested viewing interval is produced. Any terminal supported by the VAX/VMS operating system with dimensions of at least 80 columns by 24 rows can be used. (You may have to issue the DCL command SET TERMINAL to set the proper dimensions.) Display output can also be routed to a file for subsequent printing.

The amount of time between screen displays is determined by the /VIEWING_TIME value. Effective viewing time varies, however, depending on whether you are running MONITOR on your local system or on a remote node. For remote access, the time required to display the screen is included in the viewing time, while for local access, this time is not included. You will therefore probably want to use a larger viewing time than the 3-second default when running MONITOR on a remote system. The value appropriate for remote access depends on your terminal baud rate. For a 9600–baud terminal line, 6 seconds is a reasonable viewing time. For lower-speed lines, raise the viewing time appropriately.

By pressing CTRL/W, you can temporarily override the /VIEWING_TIME value and generate a new display immediately following the current one. This feature is useful when the MONITOR display area has been overwritten by an operator message. You can also use CTRL/W in conjunction with a large /VIEWING_TIME value to generate display events on demand.

3.2 Display Data

With the exception of the PROCESSES class, all displayable data items are rates or levels. Rates are shown in number of occurrences per second. A level is a value that indicates the size of the monitored data item.

MONITOR can display any of four different statistics for each data item, as follows:

- Current rate or level
- Average rate or level
- Minimum rate or level
- Maximum rate or level

The last three statistics are measured since the beginning of the MONITOR request. The current statistic displays the most recently collected value for the rate or level. Any one or all four of the statistics can be requested. For certain classes, all the above statistics can be expressed as percentages.

3.3 Screen Formats

With the exception of the PROCESSES, SYSTEM, and CLUSTER classes, there are two basic screen formats used for displaying MONITOR class data: the single-statistic screen and the multiple-statistic screen. The formats vary slightly depending on whether the class being displayed is a system or component class.

Observe that there are three characteristics common to the screen formats:

1. The date and time appearing in the heading of each screen refer to the time at which the displayed data was originally collected.
2. The name of the node on which the data was originally collected also appears in the heading (except when playing back files that do not contain node name information, or when displaying CLUSTER class data). The node name is obtained from the SCSNODE system parameter or, if SCSNODE is null, from the SYS$NODE logical name established by DECnet.
3. The bottom line of the display is used for status information pertaining to the current MONITOR request.
   - If data collection is from a file of previously recorded monitor data, the word PLAYBACK appears at the left margin of the line. If, instead, the currently running system is being monitored, the word does not appear.
   - If a summary file has been requested, the word SUMMARIZING appears in the middle of the line; otherwise, it does not appear.
   - If creation of a recording file has been requested, the word RECORDING appears at the right margin of the line; otherwise, it does not appear.

3.3.1 Single-Statistic Screen for System Classes

This bar-graph style screen is used whenever one statistic (current, average, minimum, or maximum) is requested. Example MON–1 exhibits the maximum statistic for the STATES class. For other classes and statistics, the screen format remains the same, with different heading and data item descriptions. If the display of percentages is requested, the percent symbol (%) appears in the title and next to the numbers along the top of the graph. All examples in this screen format are rounded up or down to seven whole numbers (except percentages, which are truncated to three whole numbers).

Example MON–1 Single-Statistic Screen

```
                    VAX/VMS Monitor Utility
                         PROCESS STATES
     +-----+             on node SAMPLE
     | MAX |           15-MAY-1986 16:09:53
     +-----+

                              0         10        20        30        40
                              + - - - - + - - - - + - - - - + - - - - -+
Collided Page Wait             1 |*
Mutex & Misc Resource Wait     3 |***
Common Event Flag Wait           |
Page Fault Wait                2 |**
Local Event Flag Wait         28 |****************************
Local Evt Flg (Outswapped)     4 |****
Hibernate                     11 |***********
                                 |
Hibernate (Outswapped)         2 |**
Suspended                        |
Suspended (Outswapped)           |
Free Page Wait                   |
Compute                        4 |****
Compute (Outswapped)           1 |*
Current Process                1 |*
                                 + - - - - + - - - - + - - - - + - - - - -+
```

3.3.2 Multiple-Statistic Screen for System Classes

This tabular-style screen is used whenever all four statistics are requested with the /ALL class-name qualifier. Example MON–2 shows a multiple-statistic screen. The precision of the data items is seven whole and two decimal places. For each class, the screen format remains the same, with different heading and data item descriptions.

If you request the display of percentages, as in the MODES class example in Example MON–3, the percent sign (%) appears in the title and the headings, and the figures consist of three whole and one decimal place.

Example MON–2 Sample Multiple-Statistic Screen

```
                    VAX/VMS Monitor Utility
                    PAGE MANAGEMENT STATISTICS
                         on node SAMPLE
                      15-MAY-1986 16:13:38

                              CUR       AVE       MIN       MAX
Page Fault Rate             58.00     38.33     18.66     58.00
Page Read Rate              18.00     16.33     14.66     18.00
Page Read I/O Rate           3.33      3.16      3.00      3.33
Page Write Rate             45.00     22.50      0.00     45.00
Page Write I/O Rate          1.66      0.83      0.00      1.66
Free List Fault Rate        26.33     15.66      5.00     26.33
Modified List Fault Rate     4.66      3.83      3.00      4.66
Demand Zero Fault Rate      12.00      7.66      3.33     12.00
Global Valid Fault Rate     11.33      7.83      4.33     11.33
Wrt In Progress Fault Rate   0.00      0.00      0.00      0.00
System Fault Rate           24.33     12.83      1.33     24.33
Free List Size            3356.00   3321.50   3287.00   3356.00
Modified List Size           1.00     70.00      1.00    139.00
```

Example MON–3 Sample Multiple-Statistic Screen (Data Expressed as Percentages)

```
                    VAX/VMS Monitor Utility
                    TIME IN PROCESSOR MODES (%)
                         on node SAMPLE
                      15-MAY-1986 16:13:38

                             CUR%      AVE%      MIN%      MAX%
Interrupt Stack              20.3      21.9      20.3      23.6
Kernel Mode                  23.0      23.8      23.0      24.6
Executive Mode                3.0       3.5       3.0      24.6
Supervisor Mode               0.0       0.0       0.0       0.6
User Mode                    51.3      46.9      42.6      51.3
Compatibility Mode            2.3       3.6       0.0       3.9
Idle Time                     0.0       0.0       0.0      94.9
```

3.3.3 Component-Classes Screen

For component classes, only one data item per component is displayed on each screen. The item is identified in the upper left of the screen. Components for which statistics are reported appear in the left column of the screens. If more than one item keyword is specified with the /ITEM qualifier, or if /ITEM=ALL is specified, a new screen appears for each item selected. For example, the command

```
MONITOR DISK/ITEM=(OPERATION_RATE,QUEUE_LENGTH)
```

would produce output of the format shown in Example MON–4.

Example MON–4 Sample Component Statistics Screens

```
                    VAX/VMS Monitor Utility
                      DISK I/O STATISTICS
                         on node SAMPLE
                      15-MAY-1986 20:08:42

I/O Operation Rate                      CUR       AVE       MIN       MAX
DRA2:          SAMPLEPAGE              0.00      0.03      0.00      0.33
DRB1:          ACCREG                  0.00      0.00      0.00      0.00
DRC3:          VMS_X20R                1.99      0.19      0.00      1.99
DRC4:          SAMPLESECD01            0.00      0.00      0.00      0.00
DBA3:          UMASTER                 0.00      0.00      0.00      0.00
DBA5:          MIDNITE                 0.00      0.00      0.00      0.00
DRA7:          RES26APR                0.00      0.00      0.00      0.00
DUA4:          RES06AUG                0.00      0.00      0.00      0.00
DUA5:          VMSDOCLIB               0.00      0.00      0.00      0.00
DUA7:          OLD_QVSS$               0.00      0.00      0.00      0.00

                    VAX/VMS Monitor Utility
                      DISK I/O STATISTICS
                         on node SAMPLE
                      15-MAY-1986 20:08:45

I/O Request Queue Length                CUR       AVE       MIN       MAX
DRA2:          SAMPLEPAGE              0.00      0.00      0.00      0.00
DRB1:          ACCREG                  2.00      1.43      0.00      4.00
DRC3:          VMS_X20R                0.00      0.00      0.00      0.00
DRC4:          SAMPLESECD01            0.00      0.00      0.00      0.00
DBA3:          UMASTER                 0.00      0.00      0.00      0.00
DBA5:          MIDNITE                 0.00      0.00      0.00      0.00
DRA7:          RES26APR                0.00      0.00      0.00      0.00
DUA4:          RES06AUG                0.00      0.00      0.00      0.00
DUA5:          VMSDOCLIB               0.00      0.00      0.00      0.00
DUA7:          OLD_QVSS$               0.00      0.00      0.00      0.00
```

3.4 Recording File Output

A recording file is a VAX RMS sequential disk file that is created when a MONITOR request includes the /RECORD qualifier. A record of binary performance data is written to this file once for each requested class per interval; the record contains a predefined set of data for each of the requested performance classes. The file is created when a MONITOR request is initiated and closed when the request terminates. The resulting file can be used as a source file by later requests to format and display the data on a terminal, to create a summary file, or to record a new recording file with different characteristics.

All data pertaining to the class is recorded. Note that such is the case even if you are concurrently displaying only a single statistic or a single item of a component statistics class.

3.4.1 Disk Space for Recording Files

When recording is active (or display output is being routed to a disk file), it is possible to consume large quantities of disk space in a short period of time. In particular, if disk quota is exceeded during execution of a MONITOR request, open files are closed and the request is terminated prematurely. To avoid this situation, carefully plan recording requests by estimating the amount of disk space required, using the following rules of thumb:

- Allow 70 bytes per class per interval or, for the PROCESSES class, 70 bytes per process per interval.
- For component classes, allow 4 bytes per interval for each line displayed when /ITEM=ALL is specified.

When SYSTEM class data is recorded, the MODES, STATES, and PROCESSES classes are also recorded, even if not specifically requested. When CLUSTER class data is recorded, the MODES and DISK classes are also recorded. To estimate disk space requirements for CLUSTER recording files, multiply the amounts for these classes by the number of nodes being monitored. After estimating disk space requirements, check the amount of disk quota available, and set appropriate values for /INTERVAL and /ENDING.

If necessary, refer to the Supplemental Information Section for details on the exact recording file record sizes.

3.4.2 Recording File Version Compatibility

Before Version 4.4 MONITOR can read recording files generated by previous MONITOR versions, you must convert the files to Version 4.4 format. Use the CONVERT command described in the Commands Section of this document.

3.5 Summary Output

Summary output is an ASCII disk file consisting of one display screen image per requested class. The screen format for each class is based on the statistic requested. The only difference in format between a display screen and a summary screen image is that the word SUMMARY appears in the heading along with a beginning and ending time for the period covered by the summary. For all except the PROCESSES/TOP, SYSTEM, and CLUSTER summaries, the data contained in the summaries is identical to that shown on the final display screen (if display output was also requested).

Since the summary file reflects the accumulation of data throughout the MONITOR request, the average, minimum, and maximum statistics are of particular interest. For the TOP summaries of the PROCESSES and SYSTEM classes, the data represents the top users for the entire duration of the MONITOR request, subject to the following restriction. To be eligible for inclusion in the list of top users, a process must be present and swapped in at the beginning and end of the MONITOR request.

3.6 Multifile Summaries

Multifile summaries provide a convenient method of combining data from a number of recording files to compare AVERAGE performance statistics (excluding the PROCESSES and CLUSTER classes) for discrete time segments. You can use the /BEGINNING and /ENDING command qualifiers to delimit the desired time segment (see the Command Qualifier Section).

To request a multifile summary, you use the /SUMMARY command qualifier and specify a list of recording files with the /INPUT qualifier. Note that since only AVERAGE statistics are collected, you should not specify class-name qualifiers. Note also that multifile summaries are "static"—that is, they do not provide continuously updated displays.

Caution: Version 4.4 MONITOR file structure must be common to all recording files in the list.

3.6.1 Interpreting Multifile Summary Reports

Multifile summary reports differ from regular (single-file) reports in both content (only AVERAGE statistics are collected) and format. MONITOR formats multifile report data as follows:

- **By file**—This is the default format. For each class requested, the report displays one column of AVERAGE statistics per input file, along with beginning and ending times for each file. For files that contain data for multiple nodes, there is one column per node per file.
- **By node**—To request this format, you specify the /BY_NODE command qualifier (along with the /SUMMARY and /INPUT qualifiers) when you create the summary file. The report combines data from all files for a given node into a single column that shows the average statistic for each data item. The contribution of the data from each file is weighted by the amount of time over which the data was collected (for rate items) or by the number of collections (for level items).

For both formats, MONITOR provides "Row Sum," "Row Average," "Row Maximum," and "Row Minimum" statistics. These represent simple arithmetic operations performed on all the averages in each row of the report.

Note: Since in many cases multifile summary reports contain large amounts of data, and since they use a 132-character format, you will probably want to print them out. Moreover, a single page can display only five columns of data. Depending on the number of recording files, nodes, and classes specified, a report may extend over many pages. In that event, "Row" values appear on the final page.

The following examples illustrate differences between single-file and multifile reports. First, consider two fragments of single-file reports generated on the same node from two different recording files, which cover, respectively, a two-hour and a ten-hour period.

```
                    VAX/VMS Monitor Utility
                  PAGE MANAGEMENT STATISTICS
                        on node BLUE          From: 16-MAY-1986 09:00:00
                           SUMMARY            To:   16-MAY-1986 11:00:00

                              CUR        AVE        MIN        MAX

Page Fault Rate               ----      90.00       ----       ----

                    VAX/VMS Monitor Utility
                  PAGE MANAGEMENT STATISTICS
                        on node BLUE          From: 16-MAY-1986 11:00:00
                           SUMMARY            To:   16-MAY-1986 21:00:00

                              CUR        AVE        MIN        MAX

Page Fault Rate               ----       6.00       ----       ----
```

The corresponding "by node" multifile report fragment for the entire period shows that the average Page Fault Rate is weighted toward the figure that represents the larger elapsed time:

```
          +-----+          VAX/VMS Monitor Utility
          | AVE |        PAGE MANAGEMENT STATISTICS
          +-----+             Multifile SUMMARY

            Node:       BLUE (2)
            From: 16-MAY-1986 09:00       Row     Row       Row       Row
            To:   16-MAY-1986 21:00       Sum  Average   Minimum   Maximum

Page Fault Rate               20.00      20.0      20.0     20.00     20.00
```

The "Row" statistics provided in multifile reports are not time-weighted; they are meaningful only when all input files that contribute to the report cover a common time period, as in Example MON–6 ("by node" report for nodes MOE, CURLEY, and LARRY) in Section 3.6.3. Thus, as the following example shows, "Row" statistics would not be useful in a "by file" report for node BLUE, because the contributing files covered *different* time periods:

```
          +-----+          VAX/VMS Monitor Utility
          | AVE |        PAGE MANAGEMENT STATISTICS
          +-----+             Multifile SUMMARY

            Node:        BLUE                BLUE
            From: 16-MAY-1986 09:00  16-MAY-1986 11:00       Row     Row       Row       Row
            To:   16-MAY-1986 11:00  16-MAY-1986 21:00       Sum  Average   Minimum   Maximum

Page Fault Rate               90.00                6.00      96.0     48.0      6.00     90.00
```

Those two examples illustrate how MONITOR formats multifile report data. Each column of averages is headed by the name of the node on which the data was collected, the requested beginning and ending times, and (for "by node" reports) a parenthesized number signifying the number of input files that contributed data to the column. If no explicit beginning and ending times are specified in the summary request, the times stored in the files are listed.

Note that if a column in a "by node" report contains data from more than one input file, the earliest beginning time and the latest ending time among all the time stamps in those files are listed. *You must therefore exercise caution in interpreting "by node" reports, because such reports may include in the listed time range a period during which no data was collected.*

3.6.2 Using Multifile Summary Reports in Single-Node Environments

In single-node environments, "by file" and "by node" reports have the following applications:

- **By file**—You can use this type of report (which contains one column of average statistics per input file) when you want to compare data from *several different time segments*. The input files selected must already contain the time segments of interest when the multifile summary is run; the /BEGINNING and /ENDING qualifiers cannot be used for this purpose, because they can define only one time segment. If necessary, execute a preliminary MONITOR command to rerecord an input file and write data for the desired time segment to a new file.

  Example MON–5 at the end of this section shows a multifile report generated from three input files, each of which contained data for the period 8 A.M. to noon on a different day. Some of these files may have been created as a result of rerecording larger files to extract only the 8 A.M. to noon time segment.

  Note that the average page fault rate for a morning during the week of 11 March was 28.4, and that the daily averages for that time period ranged from 21.74 to 39.53.

- **By node**—If you specify the /BY_NODE qualifier, you can combine data from several input files to produce a single average statistic for each data item. If continuous recording is implemented, so that MONITOR data is recorded whenever the system is up, you can produce a report that shows averages *for any time segment*, regardless of how many input files are included (up to the maximum of 125). Use the /BEGINNING and /ENDING qualifiers to define the time segment of interest.

Example MON–5 shows a typical "by file" multifile summary report for three input files on a single node. The summary was requested with the following command:

```
MONITOR /INPUT=(11MAR,12MAR,13MAR)/NODISPLAY/SUMMARY PAGE
```

Example MON–5 Sample Single-Node Multifile Summary

```
+-----+          VAX/VMS Monitor Utility
| AVE |        PAGE MANAGEMENT STATISTICS
+-----+             Multifile SUMMARY

  Node:       YELLOW              YELLOW              YELLOW
  From: 11-MAY-1986 08:00 12-MAY-1986 08:00 13-MAY-1986 08:00      Row      Row      Row      Row
  To:   11-MAY-1986 12:00 12-MAY-1986 12:00 13-MAY-1986 12:00      Sum  Average  Minimum  Maximum

Page Fault Rate                 39.53               23.98               21.74     85.2     28.4    21.74    39.53
Page Read Rate                  14.12                3.30                2.21     19.6      6.5     2.21    14.12
Page Read I/O Rate               1.73                0.52                0.43      2.7      0.9     0.43     1.73
Page Write Rate                 11.21                1.54                1.11     13.7      4.6     1.11    11.21
Page Write I/O Rate              0.11                0.01                0.01      0.1      0.0     0.00     0.11

Free List Fault Rate            10.28                5.00                4.73     20.0      6.6     4.73    10.28
Modified List Fault Rate         5.51                4.77                4.53     14.8      4.9     4.53     5.51
Demand Zero Fault Rate          11.58                5.06                4.21     20.8      6.9     4.21    11.58
Global Valid Fault Rate         10.25                8.54                7.76     26.5      8.8     7.76    10.25
Wrt In Progress Fault Rate       0.03                0.01                0.01      0.0      0.0     0.01     0.03
System Fault Rate                0.04                0.09                0.05      0.2      0.0     0.04     0.09

Free List Size                6829.60             7102.33             7271.85  21203.7   7067.9  6829.60  7271.85
Modified List Size             257.31              210.41              216.91    684.6    228.2   210.41   257.31
```

3.6.3 Using Multifile Summary Reports in VAXcluster Environments

In VAXcluster or other multinode environments (DECnet or any set of noncommunicating nodes), "by file" and "by node" reports have the following applications:

- **By file**—You can use this type of report to compare several time segments as you would for the single-node case. By selecting the appropriate input files, you can include in the report data from any single node or set of nodes.
- **By node**—As in the single-node case, you can use this type of report to combine data from several input files for a given node in one column of averages. Note, however, that there is one column for each node. By specifying the /BEGINNING and /ENDING qualifiers to select a common time period, you can use the report to make node-to-node comparisons. In addition, you can examine the "Row" statistics to evalute overall cluster performance.

For VAXcluster environments only, you can use the /NODE qualifier to select data for one or more nodes from the set of input files. Moreover, you can combine data for those nodes by specifying the /BY_NODE qualifier.

In Example MON–6 below, consider the Idle Time item from the MODES class. The Row Sum figure (116.2) represents the average idle time for the entire cluster over the two-hour period covered by the report; the Row Average (38.7) is the average idle time per node over the same time period. The Row Minimum (0.02) and Row Maximum (92.63) figures identify the lowest and highest of the individual node averages.

Example MON–6 shows a typical VAXcluster multifile summary. It was generated by the following command:

```
MONITOR/INPUT=(MOE.DAT;*,CURLEY.DAT;*,LARRY.DAT;*) MODES,PAGE -
/SUMMARY/BY_NODE /NODISPLAY/BEGINNING="18:17"/ENDING="20:17"
```

Sample command procedures for generating multifile summaries in a VAXcluster environment are provided in the Examples Section of this document.

4 Error Messages

The *VAX/VMS System Messages and Recovery Procedures Reference Manual* lists the messages generated by MONITOR and provides explanations and suggested user actions.

Example MON–6 Sample VAXcluster Multifile Summary

```
+------+          VAX/VMS Monitor Utility
| AVE |          TIME IN PROCESSOR MODES
+------+             MULTI-FILE SUMMARY
```

Node:	MOE	CURLEY (2)	LARRY	Row	Row	Row	Row
From:	15-MAY-1986 18:17	15-MAY-1986 18:17	15-MAY-1986 18:17	Sum	Average	Minimum	Maximum
To:	15-MAY-1986 20:17	15-MAY-1986 20:17	15-MAY-1986 20:17				
Interrupt Stack	6.51	0.50	6.25	13.2	4.4	0.50	6.51
Kernel Mode	25.73	0.42	12.43	38.5	12.8	0.42	25.73
Executive Mode	9.46	0.95	1.81	12.2	4.0	0.95	9.46
Supervisor Mode	1.97	0.00	0.16	2.1	0.7	0.00	1.97
User Mode	32.72	5.33	79.32	117.3	39.1	5.33	79.32
Compatibility Mode	0.00	0.07	0.00	0.0	0.0	0.00	0.07
Idle Time	23.61	92.63	0.02	116.2	38.7	0.02	92.63

```
+------+          VAX/VMS Monitor Utility
| AVE |          PAGE MANAGEMENT STATISTICS
+------+             MULTI-FILE SUMMARY
```

Node:	MOE	CURLEY(2)	LARRY	Row	Row	Row	Row
From:	15-MAY-1986 18:17	15-MAY-1986 18:17	15-MAY-1986 18:17	Sum	Average	Minimum	Maximum
To:	15-MAY-1986 20:17	15-MAY-1986 20:17	15-MAY-1986 20:17				
Page Fault Rate	36.73	8.81	0.49	46.0	15.3	0.49	36.73
Page Read Rate	14.28	4.71	0.00	19.0	6.3	0.00	14.28
Page Read I/O Rate	1.20	0.70	0.00	1.9	0.6	0.00	1.20
Page Write Rate	0.00	0.00	0.00	0.0	0.0	0.00	0.00
Page Write I/O Rate	0.00	0.00	0.00	0.0	0.0	0.00	0.00
Free List Fault Rate	8.60	1.40	0.24	10.2	3.4	0.24	8.60
Modified List Fault Rate	5.83	2.29	0.00	8.1	2.7	0.00	5.83
Demand Zero Fault Rate	12.96	1.68	0.24	14.8	4.9	0.24	12.96
Global Valid Fault Rate	8.10	2.69	0.00	10.8	3.6	0.00	8.10
Wrt In Progress Fault Rate	0.00	0.00	0.00	0.0	0.0	0.00	0.00
System Fault Rate	4.92	0.53	0.18	5.6	1.8	0.18	4.92
Free List Size	7586.30	8630.14	9665.06	25881.5	8627.1	7586.30	9665.06
Modified List Size	87.69	324.07	32.12	443.8	147.9	32.12	324.07

COMMAND QUALIFIERS

This section describes qualifiers for the MONITOR classname and SET DEFAULT commands. Note that these commands accept the same qualifiers. The qualifiers follow the standard rules of DCL grammar, as specified in the *VAX/VMS DCL Concepts Manual*. Thus, you can abbreviate any qualifier or keyword as long as the abbreviation is not ambiguous. The asterisk and the percent sign can be used as wildcard characters unless otherwise noted.

/BEGINNING

Specifies the time that monitoring begins.

FORMAT

/BEGINNING=*time*

time
Specifies a combination of absolute and delta times. Observe the syntax rules for time values described in the *VAX/VMS DCL Concepts Manual*.

DESCRIPTION

If you are monitoring a running system and you omit the /BEGINNING qualifier, monitoring begins at the time you issue the MONITOR command. However, if you have also specified the /INPUT qualifier to play back data from an input recording file, /BEGINNING defaults to the beginning time recorded in the input file. If you specify /BEGINNING with a time, but are playing back a recording file, MONITOR selects whichever is later: the beginning time of the file or the beginning time you specify. If you are monitoring a remote node, the local node time is used to determine beginning time.

If you specify a future time for a request to monitor a running system, MONITOR issues an informational message, and the process issuing the request hibernates until the specified time. This feature can be useful when you run MONITOR from a batch job.

/BY_NODE

Specifies that performance class data in a multifile summary be displayed as a single column of AVERAGE statistics for each node.

FORMAT

/[NO]BY_NODE

DESCRIPTION

The /BY_NODE qualifier can be specified only in combination with the /SUMMARY qualifier. One column of AVERAGE statistics per node appears for each class requested.

Multifile summaries include one column of AVERAGE statistics for each node requested in each input file. (For more information on multifile summaries, see Section 3.6.)

/COMMENT

Specifies an ASCII string to be stored in the output recording file. The string can contain up to 60 characters.

FORMAT

/COMMENT="*string*"
/NOCOMMENT

"string"
Is a comment string up to 60 characters in length.

DESCRIPTION

The /COMMENT qualifier is valid only when /RECORD is also specified. If you omit the qualifier or specify /NOCOMMENT, a string consisting of 60 blanks is stored in the recording file by default. When a recording file containing a comment is played back, the comment is included in the heading of the display or single-file summary.

/DISPLAY

Specifies whether information collected by MONITOR is to be displayed as ASCII screen images, and optionally names the disk file to contain the output.

FORMAT

/DISPLAY*[=file-spec]*
/NODISPLAY

[=file-spec]
Is the specification of the file to which output is directed.

DESCRIPTION

If you omit the optional file specification, output is written to SYS$OUTPUT.

By default, display output is produced. Note, however, that display output is never produced when multifile summary is requested. Sections 3.1 to 3.3 describe the display output formats.

/ENDING

Specifies the time that monitoring ends.

FORMAT

/ENDING=*time*

time
Specifies a combination of absolute and delta times. Observe the syntax rules for time values described in the *VAX/VMS DCL Concepts Manual.*

DESCRIPTION

If you are monitoring a running system and you omit the /ENDING qualifier, monitoring continues until you terminate the request with CTRL/C or CTRL/Z. If you have also specified the /INPUT qualifier, so that data is played back from an input recording file, /ENDING defaults to the ending time recorded in the input file. If you specify /ENDING with a time, but are playing back a recording file, MONITOR selects the earlier of the ending time of the file and the ending time you specify. For live requests, the local node's time stamp is used to determine ending time.

You can prematurely terminate a request, regardless of the value of the /ENDING qualifier, by pressing CTRL/C or CTRL/Z. To prematurely terminate a request running in a noninteractive process (that is, a batch job or a detached process or subprocess), issue the appropriate DCL command to terminate the process.

/FLUSH_INTERVAL

Specifies the interval, in seconds, at which data collected by MONITOR (contents of MONITOR buffers) is written to disk. Values must be in the range of 1 through 9,999,999. The default interval is 300 seconds.

FORMAT

/FLUSH_INTERVAL=*seconds*

seconds
Is a value in the range of 1 through 9,999,999.

DESCRIPTION

If you are writing data to a shared recording file currently in use, you should specify a short interval to ensure that others accessing the file receive data that is as current as possible. The smaller the interval, the less data is lost if a system failure occurs while recording.

/INPUT

Controls whether performance data is played back from one or more input files or collected from the running system.

FORMAT

/INPUT*[=(file-spec,...)]*
/NOINPUT

file-spec(,...)
Specifies one or more input files. If you specify more than one file, enclose the list in parentheses and separate the file specs with commas. Wildcard characters are allowed in the file specification.

Caution: Version 4.4 MONITOR file structure must be common to all recording files in the list.

DESCRIPTION

With multiple input files, you must use the /SUMMARY qualifier. The maximum number of files MONITOR will accept for a multifile summary is 125.

In a list of input files, any omitted segment of the file specification (name or type) is defaulted to the corresponding segment of the previous file specification.

If you omit the file type, the default file type DAT is used. If you omit the file specification, MONITOR assigns the default filename MONITOR.DAT. The current device and directory defaults are applied.

If you omit the qualifier, performance data is collected from the running system.

/INTERVAL

Specifies the sampling interval between data collection events, recording events, and display events.

FORMAT

/INTERVAL=*seconds*

seconds
Is a value in the range of 1 through 9,999,999.

DESCRIPTION

To understand how to use the /INTERVAL qualifier, you must be aware of various events occurring periodically within a MONITOR request. These are the collection event, the recording event, and the display event.

The /INTERVAL qualifier is the primary means of controlling the frequency of these events. When a collection event occurs, raw data for all requested classes is collected from the operating system or from a previously recorded file. When a recording event occurs, data for all requested classes is written to a recording file. When a display event occurs, a screen image is composed, for a single class, from the accumulated data collected for that class since the beginning of the MONITOR request.

For live collection requests, a collection event is always followed immediately by a recording event (if requested). The frequency of collection-recording event pairs is controlled by the /INTERVAL qualifier, which specifies the number of seconds that must elapse between occurrences of the event pair. Display events occur asynchronously to collection-recording event pairs, at a frequency governed by the /VIEWING_TIME qualifier.

For playback requests, a collection event occurs each time a new interval is encountered in the input file of previously recorded data. A recording event (if requested) does not necessarily follow immediately as in the case of live collection. Its frequency is still governed by the /INTERVAL qualifier; the specified /INTERVAL value is interpreted in terms of the /INTERVAL value specified when the input file was created. The new value must be an integral multiple of the original value. A recording event is then triggered every time an interval is encountered in the input file that is the appropriate multiple of the original interval. For playback requests, occurrences of display events (if requested) are indicated in exactly the same way as recording events—with the /INTERVAL qualifier—and immediately follow recording events (if both are specified). The actual length of time a displayed image remains on the screen is still specified with the /VIEWING_TIME qualifier, but, unlike the live collection case, this qualifier is not used to signal a display event. Table MON–2 summarizes which qualifiers cause the various MONITOR events.

Table MON–2 Relationship of MONITOR Command Qualifier to Event

Event	Live Collection Qualifier	Playback Qualifier
Collection	/INTERVAL	Original /INTERVAL value (from file)
Recording	/INTERVAL	/INTERVAL
Display	/VIEWING_TIME	/INTERVAL

Note that, for live requests, the collection interval is defined as the number of seconds from the end of one collection event to the beginning of the next. A collection event includes collection for all requested classes on all nodes specified. (For multiple-node requests, a collection event must complete on all nodes before a new event is initiated.) So, the elapsed time from the beginning of one collection event to the beginning of the next is the interval value plus the time it takes to do the collection. For some requests, notably those including many classes or the PROCESSES, CLUSTER, or SYSTEM classes, collection time can be significant.

For /INPUT requests, the interval value defaults to the value specified in the input recording file. The default for monitoring the running system is 3 seconds for all classes except ALL_CLASSES, CLUSTER, and SYSTEM, which have a default of 6 seconds.

/NODE

Specifies the nodes—up to 16 in a VAXcluster—for which data is to be collected.

FORMAT

/NODE=*(nodename,...)*

nodename(,...)
Specifies one or more node names. If you specify more than one name, separate the names with commas and enclose the list in parentheses.

DESCRIPTION

You can specify a maximum of 16 node names with the /NODE qualifier.

If you specify multiple node names with multiple *system* classes, MONITOR displays one class at a time for each node. For example, the command MONITOR/NODE=(NODE_A,NODE_B) STATES,MODES generates STATES data for NODE_A and NODE_B, and then MODES data.

Note that if you specify the /ITEM class-name qualifier with the DISK or SCS classes, MONITOR displays one item at a time for each node in turn.

/OUTPUT

Used with the CONVERT command, this qualifier specifies the name of the converted recording file.

FORMAT

/OUTPUT=*file-spec*

file-spec
Is the file specification of the output file. The default specification is MONITOR.DAT. File lists are not permitted.

DESCRIPTION

Recording files produced using earlier MONITOR versions must be converted to Version 4.4 format before they can be played back with Version 4.4 MONITOR.

/RECORD

Specifies that a binary disk file be created containing all collected data for the request.

FORMAT

/RECORD*[=file-spec]*
/NORECORD

file-spec
Is the name of the recording file. Note that recording is restricted to files on disks. No wildcard characters are allowed in the file specification. If you omit the file type, the default file type is DAT. If you omit the file specification, output is generated to a file named MONITOR.DAT, in the current default device and directory. If you specify an existing file but omit the version number, a new version of the file is created.

DESCRIPTION

The output consists of all data for the requested classes, regardless of the class-name qualifiers specified. Note that recording file output is not produced when a multifile summary is requested.

By default, no recording file output is produced.

For more information on MONITOR recording file output, see Section 3.4. Recording file record formats are described in the Supplemental Information Section.

/SUMMARY

Specifies that an ASCII disk file be created containing summary statistics on all collected data for this request.

FORMAT

/SUMMARY*[=file-spec]*
/NOSUMMARY

file-spec
Is the name of the summary file. If the optional file specification is omitted, it defaults to MONITOR.SUM. By default, no summary output is produced.

DESCRIPTION

The summary file, generated at the end of monitoring, contains one or more pages of output for each requested class. The format of each page is similar to that of display output, and is determined by the class-name qualifiers. The /ALL qualifier is applied to all class-names for which no other qualifier is specified.

Summary output formats are described in Section 3.5; multifile summaries are described in Section 3.6.

/VIEWING_TIME

For /DISPLAY requests, this qualifier specifies the duration for each screen image display.

FORMAT

/VIEWING_TIME=*seconds*

seconds
Is a value in the range of 1 through 9,999,999.

DESCRIPTION

If you are monitoring the running system, /VIEWING_TIME defaults to the /INTERVAL value. If you specify /INPUT and you are monitoring a recording file, /VIEWING_TIME defaults to 3 seconds.

Effective viewing time varies, however, depending on whether you are running MONITOR on your local system or on a remote node. For remote access, the time required to display the screen is included in the viewing time, while for local access, this time is not included. You will therefore probably want to use a larger viewing time than the 3-second default when running MONITOR on a remote system. The value appropriate for remote access depends on your terminal baud rate. For a 9600–baud terminal line, 6 seconds is a reasonable viewing time.

Note also that the time between screenfuls of data for the PROCESSES display is controlled by this qualifier.

COMMANDS

This section describes MONITOR commands. For commands that specify class-name parameters (other than ALL_CLASSES), a sample display or summary of each class is provided, along with a brief description of the items in the class.

The commands follow the standard rules of DCL grammar, as specified in the *VAX/VMS DCL Concepts Manual*. Thus, you can abbreviate any command as long as the abbreviation is not ambiguous. Note, however, that use of the RETURN key is not permitted within command lines entered in response to the MONITOR> prompt.

MONITOR recognizes the exclamation point (!) as a comment character. Thus, full- or partial-line comments are acceptable in command files specified as input to MONITOR.

CONVERT

Converts a pre-Version 4.4 MONITOR recording file to Version 4.4 format.

FORMAT

CONVERT *file-spec*

command parameter

file-spec

Specifies the file to be converted. The default file specification is MONITOR.DAT

command qualifier

/OUTPUT

Is the file specification of the converted file. The default specification is MONITOR.DAT.

DESCRIPTION

You must convert pre-Version 4.4 recording files to Version 4.4 format before attemping to play them back with Version 4.4 MONITOR.

EXAMPLE

```
MONITOR> CONVERT 24MAY_MONITOR.DAT/OUTPUT=24MAY_NEWMON.DAT
```

The command in this example converts the file 24MAY_MONITOR.DAT to Version 4.4 format and names the output file 24MAY_NEWMON.DAT.

EXECUTE (@)

Executes a series of Monitor Utility commands contained in a file.

FORMAT

EXECUTE (@) *file-spec*

command parameter

file-spec
Specifies a command file to be executed by the EXECUTE (@) command.

command qualifiers

None.

DESCRIPTION

With the EXECUTE command, you can direct MONITOR to obtain command input from a specified file rather than from the terminal. The file may contain any valid Monitor Utility command except an EXECUTE (@) command. Commands in the file are executed sequentially. If you omit the optional file specification, the default is MONITOR.MON.

After the file has executed, subsequent commands are obtained from the terminal.

EXAMPLE

```
MONITOR> EXECUTE INQMEM.MON
    .
    .
    .
MONITOR> MONITOR /RECORD
```

Contents of the file INQMEM.MON are

```
! This file sets defaults for a memory management inquiry using
! INTERVAL=5, PAGE, IO, and PROCESSES/TOPFAULT
!
    .
    .
    .
SET DEFAULT /INTERVAL=5 PAGE, IO, PROCESSES/TOPFAULT
```

In this example, appropriate default values for a memory management investigation are established in the file INQMEM.MON, and the file is executed with the EXECUTE command. Then a subsequent MONITOR command uses those defaults, adding the /RECORD qualifier, to display and record the selected classes with a 5-second interval.

Note that the defaults established when the file INQMEM.MON is executed remain in effect until changed explicitly or until the utility is exited.

EXIT

Terminates MONITOR, returning control to command level.

FORMAT	EXIT
command parameters	*None.*
command qualifiers	*None.*

HELP

The HELP command displays HELP information on MONITOR.

FORMAT

HELP *[command]*

command parameters

command
Specifies the name of a MONITOR command for which HELP is desired.

command qualifiers

None.

EXAMPLE

```
MONITOR> HELP INITIALIZE
INITIALIZE
   Re-establish initial default values for MONITOR qualifiers and class-name
   parameters.
Topic?
```

The command in this example requests help information on the INITIALIZE command.

INITIALIZE

The INITIALIZE command reestablishes initial default settings for parameters and qualifiers previously altered by the SET DEFAULT command.

FORMAT	INITIALIZE
command parameters	*None.*
command qualifiers	*None.*

MONITOR ALL_CLASSES

The MONITOR ALL_CLASSES command initiates monitoring of statistics for all classes except the CLUSTER class.

FORMAT

MONITOR ALL_CLASSES

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

If you do not specify any qualifiers with the ALL_CLASSES parameter, normal default output is produced for each class. (See Table MON–1.) The qualifiers have no effect on display of the PROCESSES class.

Note that the default interval is six seconds.

The MONITOR ALL_CLASSES command is particularly useful for playback of recording files, since it eliminates the need to specify the particular classes of performance data the recording file contains. To override any of the default qualifiers, specify the class name with the qualifier after specifying ALL_CLASSES.

EXAMPLE

```
MONITOR> MONITOR/INPUT=SYS$MANAGER:LOADBAL.DAT ALL_CLASSES,PROCESSES/TOPCPU
```

This command initiates playback of the recording file SYS$MANAGER:LOADBAL.DAT. All data contained in the file will be displayed.

MONITOR CLUSTER

Initiates monitoring of the CLUSTER statistics class, which shows clusterwide CPU, memory, disk, and locking activity.

FORMAT

MONITOR CLUSTER

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

For the CLUSTER class, MONITOR collects data items for up to 16 nodes in a VAXcluster. Because this class combines the most significant clusterwide performance statistics in a single display, it is particularly useful to cluster managers and other users seeking a general overview of cluster activity.

Note that MONITOR does not recognize nodes that enter the cluster while a request is active. MONITOR will therefore not collect data for such nodes. Note also that the ALL_CLASSES and CLUSTER classes are mutually exclusive.

The CLUSTER class includes the following data items:

- CPU Busy—Percentage of CPU in use; includes activity in all processor modes (except Idle Time) for each node
- Percent Memory In Use—Memory in use on each node; calculated by dividing the Free List Size by total available memory and subtracting the result from 100%
- I/O Operation Rate—Total rate of disk I/O operations on each disk by all nodes currently active in the request. Note that for MSCP-served disks, the operation rate includes all operations initiated on requested remote nodes, as well as all operations issued on the serving node to support remote operations.
- Total ENQ/DEQ Rate—Sum of all local, incoming, and outgoing ENQ's, DEQ's, and conversions

Two display formats are provided, depending on the class-name qualifier specified:

- A tabular style format for the /ALL qualifier
- A bar-graph style format for the /AVERAGE, /CURRENT, /MAXIMUM, and /MINIMUM qualifiers

Note to Cluster Managers on MONITOR_SERVER Process

When users issue the MONITOR CLUSTER command, MONITOR activates the image SYS$SYSTEM:VPM.EXE, which creates a process called MONITOR_SERVER on each active cluster node. (If users specify the /NODE qualifier with the MONITOR CLUSTER command, or with any command of the form MONITOR classname, MONITOR creates the process only on the specified nodes.) The purpose of the server process is to gather data from remote nodes for live display or recording on the local node. To ensure accurate and timely data collection, the process is started at priority 15. *Since server processes consume minimal resources, they have no significant effect on system performance.*

By default, MONITOR_SERVER processes are started in the system DECNET account, which is created when the NETCONFIG.COM command procedure executes at bootstrap time. If for some reason this account is not present on your system, you must either create it by executing NETCONFIG.COM, or specify another account in which the server processes can be started. If you want to start the processes in another account, use the following sequence of commands to define VPM as known object 51 in the DECnet database and associate the object with the desired account.

```
$ SET PROCESS/PRIVILEGE=SYSPRV
$ RUN SYS$SYSTEM:NCP
NCP> DEFINE OBJECT NUMBER 51 -
 _ NAME VPM -
 _ FILE SYS$SYSTEM:VPM.EXE -
 _ PROXY NONE -
 _ ACCOUNT accountname -
 _ USERNAME username -
 _ PASSWORD password
NCP> SET OBJECT NUMBER 51 -
 _ NAME VPM -
 _ FILE SYS$SYSTEM:VPM.EXE -
 _ PROXY NONE -
 _ ACCOUNT accountname -
 _ USERNAME username -
 _ PASSWORD password
NCP> EXIT
$ SET PROCESS/PRIVILEGE=NOSYSPRV
```

For each server process, MONITOR creates on the local node a log file to which information on server connection activity, including error messages, is written. Note that error messages are written to the file only when errors occur, and that a single version is maintained for the life of the system. The default file specification has the form SYS$COMMON:[SYSMGR]VPM$nodename.LOG. The *nodename* portion of the specification identifies the node on which the MONITOR_SERVER process has been started.

If you want to change the default specification, you can redefine the executive-mode logical name VPM$LOG_FILE in the system logical name table on the appropriate nodes. For example, if you wanted to write server error logging data to the file WRKD:[MONSERVER]VPM_ERRORS.LOG, you would define VPM$LOG_FILE as follows:

```
$ DEFINE/SYSTEM/EXECUTIVE_MODE VPM$LOG_FILE -
_$ WRKD:[MONSERVER]VPM_ERRORS.LOG
```

To direct to a single file data for all MONITOR_SERVER processes on the cluster, you could assign the logical name the same value on each member system. Note that because the log files are created as shared sequential files, multiple server processes can access them simultaneously.

If you routinely monitor your cluster, you can reduce server startup time significantly by creating MONITOR_SERVER processes on each member node at bootstrap time and maintaining the processes for the life of the system. To do so, add the following lines to the appropriate site-independent startup command files:

```
$ DEFINE/SYSTEM/EXECUTIVE_MODE VPM$SERVER_LIVE TRUE
$ RUN/DETACH SYS$SYSTEM:VPM.EXE
```

You can issue these commands interactively at any time. Note, however, that you require the following privileges: ALTPRI, NETMBX, PSWAPM, SYSNAM, SYSPRV, and TMPMBX.

EXAMPLES

1

```
MONITOR> MONITOR CLUSTER/ALL

                    VAX/VMS Monitor Utility
                      CLUSTER STATISTICS
                        on node CURLEY
                     5-MAY-1986 12:25:13

CPU Busy                              CUR        AVE        MIN        MAX
LARRY                              100.00     100.00     100.00     100.00
CURLEY                             100.00      99.83     100.00     100.00
MOE                                  8.52       8.50       8.52       8.52

                    VAX/VMS Monitor Utility
                      CLUSTER STATISTICS
                        on node CURLEY
                     5-MAY-1986 12:25:19

%Memory In Use                        CUR        AVE        MIN        MAX
MOE                                 88.00      88.00      88.00      88.00
LARRY                               78.00      78.00      77.00      78.00
CURLEY                              72.00      72.50      72.00      72.00

                    VAX/VMS Monitor Utility
                      CLUSTER STATISTICS
                        on node CURLEY
                     5-MAY-1986 12:25:25

I/O Operation Rate                    CUR        AVE        MIN        MAX
$111$DUA7:    (DECEIT) SQMCLUSTERV4  0.48       6.53       0.48      10.41
$111$DUA6:    (DECEIT) QUALD         1.93       1.07       0.00       1.93
$111$DUA4:    (DECEIT) PAGESWAPDISK  1.44       0.96       0.00       1.44
$111$DUA2:    (DECEIT) TSDPERF       0.32       0.53       0.16       1.12
LARRY$DRA3:            QUALQUEST     0.00       0.21       0.00       0.64
MOE$DMA1:              UVMSQAR       0.00       0.00       0.00       0.00
MOE$DRA5:              USER01        0.00       0.00       0.00       0.00
LARRY$DRA4:            TIMEDEV       0.00       0.00       0.00       0.00
LARRY$DBB3:            REGLIB        0.00       0.00       0.00       0.00
$111$DUA3:    (DECEIT) DUMPDISK      0.00       0.00       0.00       0.00
$111$DUA5:    (DECEIT) BPMDISK       0.00       0.00       0.00       0.00
$111$DJA8:    (DECEIT) ORLEAN        0.00       0.00       0.00       0.00
$111$DJA10:   (DECEIT) QMISDATABASE  0.00       0.00       0.00       0.00
$111$DJA9:    (DECEIT) MPI$DATA      0.00       0.00       0.00       0.00

                    VAX/VMS Monitor Utility
                      CLUSTER STATISTICS
                        on node CURLEY
                     5-MAY-1986 12:25:56

Tot ENQ/DEQ Rate                      CUR        AVE        MIN        MAX
MOE                                  7.90      14.92       0.00      43.12
LARRY                               20.48      14.64       0.00      46.92
CURLEY                               1.93      13.29       0.00      57.30
```

This example shows the tabular style format for the CLUSTER display.

MONITOR
MONITOR CLUSTER

```
2   MONITOR> MONITOR CLUSTER
    Statistic: CURRENT          VAX/VMS Monitor Utility      11-MAY-1986 14:32:14
                                   CLUSTER STATISTICS
                       CPU                      |                MEMORY
                                                |
    CPU Busy             0   25   50   75  100|%Memory In Use   0   25   50   75  100
                         +----+----+----+----+|                 +----+----+----+----+
    CURLEY           100 |********************|LARRY          94 |******************
    LARRY             68 |*************       |CURLEY         91 |******************
    MOE               22 |****                |MOE            12 |**
                         |                     |                 |
                         |                     |                 |
                         |                     |                 |
    -----------------------------------------+-----------------------------------
                       DISK                     |                LOCK
                                                |
    I/O Operation Rate   0   25   50   75  100|Tot ENQ/DEQ Rate 0  125  250  375  500
                         +----+----+----+----+|                 +----+----+----+----+
    $111$DUA7:        52 |**********          |CURLEY         103 |****
    $111$DUA6:        41 |********            |MOE             82 |***
    $111$DUA11:       40 |********            |LARRY           35 |*
    $111$DUA5:        39 |*******             |                 |
    MOE$DJA68:           |                    |                 |
    $111$DUA3:           |                    |                 |
```

This example shows the bar-graph style format for the CLUSTER display.

MONITOR DECNET

The MONITOR DECNET command initiates monitoring of the DECNET class, which includes information on DECnet–VAX network activity.

FORMAT

MONITOR DECNET

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The DECNET class consists of the following data items:

- Arriving Local Packet Rate—Rate at which local packets are being received
- Departing Local Packet Rate—Rate at which local packets are being sent
- Arriving Transit Packet Rate—Rate at which transit packets are arriving
- Transit Congestion Loss Rate—Rate of transit congestion loss
- Receiver Buff Failure Rate—Rate of receiver buffer failures
- LRPs Available— Number of large request packets not in use

EXAMPLE

```
MONITOR> MONITOR DECNET

                    VAX/VMS Monitor Utility
                      DECNET STATISTICS
                        on node SAMPLE
                    15-MAY-1986 22:22:44

                                  CUR       AVE       MIN       MAX

Arriving Local Packet Rate       9.54      5.08      0.00     11.25
Departng Local Packet Rate       9.22      4.66      0.00     10.92

Arriving Trans Packet Rate       0.00      0.00      0.00      0.00
Trans Congestion Loss Rate       0.00      0.00      0.00      0.00

Receiver Buff Failure Rate       0.00      0.00      0.00      0.00
LRPs Available                  13.00     11.50      9.00     15.00
```

This example shows that arriving and departing network packet rates (including control packets) are roughly equivalent, and that network activity is currently at a level higher than the average since monitoring began, but not at its highest point. Note also that the count of LRPs is displayed; LRPs are used by various components of VAX /VMS, but primarily by DECnet–VAX. A sufficient number of these large request packets must be available to ensure that at peak periods of network use they are not exhausted. If they become depleted, network performance may degrade. The number of packets preallocated at boot time is determined by the SYSGEN parameter LRPCNT.

MONITOR DISK

The MONITOR DISK command initiates monitoring of the DISK statistics class.

FORMAT

MONITOR DISK

command qualifiers

/qualifier[,...]

One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL

Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE

Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT

Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/ITEM=(keyword[,...])

Selects one or more data items for inclusion in display and summary output. If you specify two or more keywords, enclose them in parentheses and separate them with commas. When the /ITEM qualifier is omitted, the default is /ITEM=OPERATION_RATE.

/MAXIMUM

Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM

Selects minimum statistics to be displayed in a bar-graph for display and summary output.

/[NO]PERCENT

Controls whether statistics are expressed as percent values in display and summary output. The /PERCENT qualifier is applicable only to the DISK, MODES, SCS, and STATES classes. By default, statistics are not expressed as percent values.

/ITEM Qualifier Keywords

ALL
Specifies that statistics on all data items collected for the disks are displayed on successive screens.

OPERATION_RATE
Specifies that I/O operation rate statistics are displayed for each disk.

QUEUE_LENGTH
Specifies that the number of I/O request packets being serviced (current or waiting) is displayed for each disk.

DESCRIPTION

The DISK class is a component class. Data items for this class are collected for each mounted disk device in a single-node or VAXcluster system. The DISK class consists of the following data items:

- I/O Operation Rate—Rate at which I/O operations occur on each disk. By comparing operation rates for all disks in the system, you can discern which disks are busy and which are idle. However, since this statistic does not provide information on the time required for individual operations, you must use discretion in interpreting it.
- I/O Request Queue Length—Number of outstanding I/O request packets. Includes the request currently being serviced and those awaiting service. Note that this item is always sampled at a 1-second interval, regardless of the value specified with the /INTERVAL command qualifier.

In the following example, typical of a VAXcluster environment, note that each disk is identified by three elements:

1. The disk name ending in a colon.
2. The name of the VAXcluster node through which the disk is accessed. This field appears only in the multiple-statistic display; it is not included in single-statistic displays or multifile summaries.
3. The volume label.

EXAMPLE

```
MONITOR> MONITOR DISK/ITEM=QUEUE_LENGTH
                              VAX/VMS Monitor Utility
                                DISK I/O STATISTICS
                                   on node SAMPLE
                                15-MAY-1986 14:19:56

I/O Request Queue Length                        CUR       AVE       MIN       MAX
SAMPLE$DBA0:              SAMPLE09APR          0.00      0.00      0.00      0.00
SAMPLE$DRA2:              SAMPLEPAGE           2.00      1.43      0.00      4.00
SAMPLE$DRB1:              ACCREG               0.00      0.00      0.00      0.00
$1$DRA5:        (MOE)     MOE$$PAGE            0.00      0.00      0.00      0.00
$1$DBA3:        (CURLEY)  UMASTER              0.00      0.00      0.00      0.00
$1$DBA5:        (CURLEY)  MIDNITE              0.00      0.00      0.00      0.00
$2$DRA7:        (LARRY)   RES26APR             0.00      0.00      0.00      0.00
$2$DRB6:        (LARRY)   CLUSTERDUMP1         0.00      0.00      0.00      0.00
$255$DUA4:      (SHEMP)   RES06AUG             0.00      0.00      0.00      0.00
$255$DUA5:      (SHEMP)   VMSDOCLIB            0.00      0.00      0.00      0.00
```

This example, typical of a VAXcluster environment, shows, for each disk, the number of I/O packets awaiting service or in service. Note that the

device SAMPLE$DRA2 is the only device with a nonzero queue length. Since MONITOR samples queue lengths every second, regardless of the collection interval value, the accuracy of the data does not depend on the collection interval.

MONITOR DLOCK

The MONITOR DLOCK command initiates monitoring of the DLOCK (distributed lock management) statistics class.

FORMAT

MONITOR DLOCK

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The DLOCK class is useful for monitoring the lock management subsystem in a VAXcluster environment. The class consists of the following data items:

- New ENQ Rate (Local)—Rate of new lock (ENQ) requests that originate and are performed on this system
- New ENQ Rate (Incoming)—Rate of new lock requests that originate on other systems and are performed on this system
- New ENQ Rate (Outgoing)—Rate of new lock requests that originate on this system and are performed on another system
- Converted ENQ Rate (Local)—Rate of lock (ENQ) conversion requests that originate and are performed on this system

- Converted ENQ Rate (Incoming)—Rate of lock conversion requests that originate on other systems and are performed on this system
- Converted ENQ Rate (Outgoing)—Rate of lock conversion requests that originate on this system and are performed on another system
- DEQ Rate (Local)—Rate of unlock (DEQ) requests that originate and are performed on this system
- DEQ Rate (Incoming)—Rate of unlock requests that originate on other systems and are performed on this system
- DEQ Rate (Outgoing)—Rate of unlock requests that originate on this system and are performed on another system
- Blocking AST Rate (Local)—Rate of lock manager blocking ASTs that originate and are performed on this system
- Blocking AST Rate (Incoming)—Rate of lock manager blocking ASTs that originate on other systems and are performed on this system
- Blocking AST Rate (Outgoing)—Rate of lock manager blocking ASTs that originate on this system and are performed on another system
- Directory Function Rate (Incoming)—Rate of requests for locks being managed by this node
- Directory Function Rate (Outgoing)—Rate of requests for locks being managed by other nodes
- Deadlock Message Rate—Rate of incoming and outgoing messages required for deadlock detection

EXAMPLE

```
MONITOR> MONITOR DLOCK

                    VAX/VMS Monitor Utility
              DISTRIBUTED LOCK MANAGEMENT STATISTICS
                          on node SAMPLE
                    15-MAY-1986 11:02:20

                                    CUR       AVE       MIN       MAX

New ENQ Rate              (Local)   15.84     11.59      1.54     26.88
                        (Incoming)   1.67      2.62      0.11     25.05
                        (Outgoing)   0.05      0.63      0.00      5.99
Converted ENQ Rate      (Local)     23.67      9.13      0.99     41.22
                        (Incoming)   4.48      5.71      0.00     70.19
                        (Outgoing)   0.00      1.43      0.00     15.90
DEQ Rate                  (Local)   15.86     11.58      1.64     26.68
                        (Incoming)   1.66      2.59      0.00     24.85
                        (Outgoing)   0.05      0.63      0.00      5.99
Blocking AST Rate       (Local)      0.00      0.00      0.00      0.01
                        (Incoming)   0.00      0.00      0.00      0.00
                        (Outgoing)   0.00      0.00      0.00      0.00
Dir Functn Rate         (Incoming)   8.00      7.33      4.66     11.00
                        (Outgoing)   1.00      0.77      0.00      2.66
Deadlock Message Rate                0.00      0.00      0.00      0.00
```

This example shows that most of the current lock management activity occurs locally, but that, at some point during the monitoring period, there was a significant amount of incoming activity.

MONITOR FCP

The MONITOR FCP command initiates monitoring of the File Control Primitive statistics class, which includes information on all Files–11 Ancillary Control Processes (ACPs) and Extended QIO Programs (XQPs) on the local node.

FORMAT

MONITOR FCP

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The FCP class consists of the following data items, all of which are displayed as occurrences per second:

- FCP Call Rate—Rate of QIO requests received by the file system.
- Allocation Rate—Rate of calls that caused allocation of disk space.
- Create Rate—Rate at which new files were created.
- Disk Read Rate—Rate of read I/O operations from disk by the file system.
- Disk Write Rate—Rate of write I/O operations to disk by the file system.

- Volume Lock Wait Rate—Rate of entry into a wait state due to contention for a volume synchronization lock. Volume synchronization locks are taken out by the XQP during file creation, deletion, extension, and truncation operations.
- CPU Tick Rate—Rate at which CPU time was used by the file system (in 10-millisecond ticks).
- File System Page Fault Rate—Rate at which page faults occurred in the file system.
- Window Turn Rate—Rate of file-map window misses.
- File Lookup Rate—Rate of filename look-up operations in file directories.
- File Open Rate—Rate at which files were opened.
- Erase Rate—Rate of erase operations issued by the file system.

EXAMPLE

```
MONITOR> MONITOR /INTERVAL=10 FCP

                    VAX/VMS Monitor Utility
                FILE PRIMITIVE STATISTICS
                       on node SAMPLE
                  15-MAY-1986 16:13:38

                              CUR       AVE       MIN       MAX

FCP Call Rate                4.62      3.80      0.33      7.61
Allocation Rate              0.99      0.24      0.00      0.99
Create Rate                  2.31      0.57      0.00      2.31

Disk Read Rate               1.98      2.48      0.33      6.95
Disk Write Rate              3.30      2.39      0.33      5.62
Volume Lock Wait Rate        4.62      3.06      0.00      6.95

CPU Tick Rate                3.63      3.88      0.33     10.26
File Sys Page Fault Rate     0.00      0.00      0.00      0.00
Window Turn Rate             1.98      0.99      0.00      1.98

File Lookup Rate             0.33      1.40      0.00      4.63
File Open Rate               2.00      3.54      2.00      5.10
Erase Rate                   0.00      0.00      0.00      0.00
```

This example shows that the rate of file opens during the last 10-second collection interval was 2.0 (for a total of 20). The average rate since the MONITOR command was issued is 3.54; the highest rate achieved during any 10-second interval is 5.10, and the lowest rate of 2.0 occurred during the last interval.

MONITOR FILE_SYSTEM_CACHE

The MONITOR FILE_SYSTEM_CACHE command initiates monitoring of the FILE_SYSTEM_CACHE statistics class.

FORMAT

MONITOR FILE_SYSTEM_CACHE

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The FILE_SYSTEM_CACHE class includes the following data items:

- Directory FCB Hit%—Percentage of directory file control block hits on the Directory Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- Directory FCB Attempt Rate—Rate at which attempts were made to find directory file control blocks in the Directory Cache.
- Directory Data Hit%—Percentage of directory data hits on the Directory Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- Directory Data Attempt Rate—Rate at which attempts were made to find directory data in the Directory Cache.

- File Header Hit%—Percentage of file header hits on the File Header Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- File Header Attempt Rate—Rate at which attempts were made to find file headers in the File Header Cache.
- File ID Hit%—Percentage of file identifier hits on the File ID Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- File ID Cache Attempt Rate—Rate at which attempts were made to find file identifiers in the File ID Cache.
- Extent Cache Hit%—Percentage of appropriate size extent hits on the Extent Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- Extent Cache Attempt Rate—Rate at which attempts were made to find appropriate size extents in the Extent Cache.
- Quota Cache Hit%—Percentage of quota entry hits on the Quota Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- Quota Cache Attempt Rate—Rate at which attempts were made to find entries in the Quota Cache.
- Bitmap Cache Hit%—Percentage of entry hits on the Bitmap Cache. The percentage value shown is the ratio of hits to the sum of hits plus misses.
- Bitmap Cache Attempt Rate—Rate at which attempts were made to find entries in the Bitmap Cache.

Note that all items shown in the FILE_SYSTEM_CACHE display except Dir FCB apply only to XQPs. The Dir FCB item applies to both XQPs and the ODS-1 ACP.

EXAMPLE

```
MONITOR> MONITOR FILE_SYSTEM_CACHE

                    VAX/VMS Monitor Utility
              FILE SYSTEM CACHING STATISTICS
                        on node SAMPLE
                   15-MAY-1986 13:08:53

                                  CUR       AVE       MIN       MAX

Dir FCB       (Hit %)           100.00    100.00      0.00    100.00
              (Attempt Rate)      1.66      0.49      0.00      1.66
Dir Data      (Hit %)           100.00    100.00      0.00    100.00
              (Attempt Rate)      4.66      1.24      0.00      4.66
File Hdr      (Hit %)            66.00     80.00      0.00    100.00
              (Attempt Rate)      1.00      0.41      0.00      1.00
File ID       (Hit %)             0.00      0.00      0.00      0.00
              (Attempt Rate)      0.00      0.00      0.00      0.00

Extent        (Hit %)             0.00    100.00      0.00    100.00
              (Attempt Rate)      0.00      0.24      0.00      1.00
Quota         (Hit %)             0.00    100.00      0.00    100.00
              (Attempt Rate)      0.00      0.16      0.00      0.66
Bitmap        (Hit %)             0.00      0.00      0.00      0.00
              (Attempt Rate)      0.00      0.00      0.00      0.00
```

The cache hits and misses reflect the effectiveness of file system caching. Generally, the size of the cache affects the hit rate. The Attempt Rate is the

sum of hits plus misses; the Hit% is the percentage of attempts that were successful.

Unlike other Monitor data items, the averages for the hit percentages are not calculated based on previous hit percentages. Instead, these values are calculated based on the total number of hits and the total number of attempts on a cache since the beginning of the Monitor request. The reason for this difference is to provide more accurate average values for the hit percentage items.

The **Directory FCB Cache** is checked whenever a directory lookup is performed. Directory lookups may be performed on file open, creation, deletion, extension, or truncation. If the file control block associated with the directory is found in the cache, a hit is recorded. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

The **Directory Data Cache** is checked whenever a file lookup is performed. Directory lookups may be performed on file open, creation, deletion, extension, or truncation. If an entry for the file being accessed is found in the directory data cache, a hit is recorded. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

The **File Header Cache** is checked on file open, close, creation, deletion, extension, or truncation. If the file header for the file being accessed is found in the File Header Cache, a hit is recorded. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

The **File Identification Cache** is a list of file identifiers that are removed on file creation and returned on file deletion. The File Id hits indicate file numbers successfully removed or returned to the File Id Cache. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

The **Extent Cache** is checked on file creation, deletion, extension, and truncation. An attempt is made to allocate space from the Extent Cache during file creation or extension. During file creation, if sufficient size is found, a hit is recorded. If the desired size is not found or an entry is forced to be split, an attempt is recorded. During file deletion, if the blocks were returned to the cache without the Extent Cache becoming too large, a hit is recorded. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

If quota checking is enabled, the **Quota Cache** is checked on file creation, deletion, extension, and truncation. If the desired entry (the identifier matching that of the requester) is found in the Quota Cache, a hit is recorded. Otherwise a miss is recorded. Both hits and misses are counted as attempts.

The **Bitmap Cache** contains blocks from the storage bitmap file. This cache is accessed when the Extent Cache cannot satisfy requests for disk space. High rates indicate fragmented volumes.

Data items in the FILE_SYSTEM_CACHE display correspond to SYSGEN ACP/XQP parameters as follows:

FILE_SYSTEM_CACHE Item	ACP/XQP Parameters
Dir FCB	ACP_SYSACC
	ACP_DINDXCACHE
Dir Data	ACP_DIRCACHE
File Hdr	ACP_HDRCACHE
File ID	ACP_FIDCACHE
Extent	ACP_EXTCACHE
	ACP_EXTLIMIT
Quota	ACP_QUOCACHE
Bitmap	ACP_MAPCACHE

When you change the ACP/XQP cache parameters, remember to reboot the system to make the changes effective. For more information on these parameters, refer to the *VAX/VMS System Generation Utility Reference Manual.*

MONITOR IO

The MONITOR IO command initiates monitoring of the IO class.

FORMAT

MONITOR IO

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The IO class includes the following data items:

- Direct I/O Rate—Rate of direct I/O (for example, disk and tape) operations
- Buffered I/O Rate—Rate of buffered I/O (for example, terminal and line printer) operations
- Mailbox Write Rate—Rate of write-to-mailbox requests received by the system
- Window Turn Rate—Rate of file-map window misses
- Log Name Translation Rate—Rate of logical name translations
- File Open Rate—Rate at which files were opened
- Page Fault Rate—Rate of occurrence of page faults for all working sets

- Page Read Rate—Rate of pages read from disk as a result of page faults
- Page Read I/O Rate—Rate of read I/O operations from disk as a result of page faults
- Page Write Rate—Rate of pages written to the page file
- Page Write I/O Rate—Rate of write I/O operations to the page file
- Inswap Rate—Rate at which working sets were read into memory from the swap file
- Free List Size—Number of pages on the free page list
- Modified List Size—Number of pages on the modified page list

EXAMPLE

```
MONITOR> MONITOR /RECORD IO

                    VAX/VMS Monitor Utility
                    I/O SYSTEM STATISTICS
                        on node SAMPLE
                    15-MAY-1986 22:22:44

                                  CUR       AVE       MIN       MAX
Direct I/O Rate                 15.33      4.46      0.33     15.33
Buffered I/O Rate               24.91     47.47     24.91     69.00
Mailbox Write Rate               0.00      0.45      0.00      2.95
Window Turn Rate                 1.66      1.56      0.33      3.97
Log Name Translation Rate       13.28     10.75      3.66     27.66
File Open Rate                   1.66      1.26      0.33      2.98
Page Fault Rate                 24.58     52.31     17.33    178.00
Page Read Rate                  12.29      9.00      0.00     26.88
Page Read I/O Rate               2.65      2.43      0.00      6.22
Page Write Rate                  0.00      6.69      0.00     58.66
Page Write I/O Rate              0.00      0.27      0.00      1.66
Inswap Rate                      0.00      0.00      0.00      0.00
Free List Size                3621.00   3604.09   3392.00   3771.00
Modified List Size              49.00     73.36      4.00    181.00
                                                          RECORDING
```

This example shows that the direct I/O rate is currently at its highest level since the MONITOR command was issued, and is significantly higher than the average rate. Termination of this command by CTRL/C and issuance of a MONITOR PROCESSES/TOPDIO command would show the top users of direct I/Os. Note that if I/O monitoring is begun at a later time, a new MONITOR request is defined. That is, it is not a continuation of the original request; the average, minimum, and maximum statistics are reinitialized. However, since the original request specified recording, that data can be played back for redisplay or summarization.

MONITOR LOCK

The MONITOR LOCK command initiates monitoring of the LOCK class.

FORMAT

MONITOR LOCK

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The LOCK class includes the following data items:

- New ENQ Rate—Rate of new lock (ENQ) requests (as opposed to conversions)
- Converted ENQ Rate—Rate of lock (ENQ) conversion requests
- DEQ Rate—Rate of unlock (DEQ) requests
- Blocking AST Rate—Rate of lock manager blocking ASTs delivered
- ENQs Forced To Wait Rate—Rate of occurrence of locks that could not be granted immediately, thus having to wait
- ENQs Not Queued Rate—Rate of occurrence of locks that could not be granted immediately but requested not to be queued, and thus received an error status instead

- Deadlock Search Rate—Rate at which a deadlock search was performed
- Deadlock Find Rate—Rate at which a deadlock was found
- Total Locks—Total number of locks in the system
- Total Resources—Total number of resources in the system

EXAMPLE

```
MONITOR> MONITOR /INPUT=LOCKSTATS.DAT/SUMMARY/NODISPLAY LOCK/AVERAGE
    .
    .
    .
MONITOR> CTRL/Z
$ TYPE MONITOR.SUM

                                VAX/VMS Monitor Utility
          +-----+               LOCK MANAGEMENT STATISTICS
          | AVE |                   on node SAMPLE          From:  15-MAY-1986 08:00:00
          +-----+                        SUMMARY            To:    15-MAY-1986 17:00:00

                                          0         5         10        15        20
                                          + - - - - + - - - - + - - - - + - - - - -+

New ENQ Rate                            2 |****
Converted ENQ Rate                      1 |**
                                          |         |         |         |         |
DEQ Rate                                3 |******
Blocking AST Rate                         |
                                          |         |         |         |         |
ENQs Forced To Wait Rate                  |
ENQs Not Queued Rate                      |
                                          |         |         |         |         |
Deadlock Search Rate                      |
Deadlock Find Rate                        |
                                          |         |         |         |         |
Total Locks                             3 |******
Total Resources                         3 |******
                                          |         |         |         |         |
                                          + - - - - + - - - - + - - - - + - - - - -+
PLAYBACK                                SUMMARIZING
```

This example shows the average use of the lock management subsystem during a typical workday, based on data that was previously recorded.

MONITOR MODES

The MONITOR MODES command initiates monitoring of the MODES class, which includes a data item for each mode of processor operation.

FORMAT MONITOR MODES

command qualifiers

/qualifier[,...]

One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL

Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE

Selects average statistics to be displayed in a bar-graph for display and summary output.

/[NO]CPU

Selects the processor-specific form of display and summary output for the MODES class (for VAX–11/782 attached processor configurations). If the attached processor is not active, the qualifier has no effect. By default, processor-specific statistics are produced for VAX–11/782 systems for display output and single-file summaries. The qualifier has no effect on multifile summaries, which use only the non-processor-specific form. Note also that processor-specific statistics are not produced, even if explicitly requested, whenever SYSTEM is part of a list of classes.

/CURRENT

Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM

Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM

Selects minimum statistics to be displayed in a bar-graph for display and summary output.

/[NO]PERCENT

Controls whether statistics are expressed as percent values in display and summary output. The /PERCENT qualifier is applicable only to the DISK,

MODES, SCS, and STATES classes. By default, statistics are not expressed as percent values.

DESCRIPTION

The following data items, included by the MODES class, can be displayed as percentages of all processor (CPU) time, or as rates of clock ticks (10 millisecond units) per second:

- Interrupt Stack—Time spent on the interrupt stack
- Kernel Mode—Time spent in kernel mode, but not on interrupt stack
- Executive Mode—Time spent in executive mode
- Supervisor Mode—Time spent in supervisor mode
- User Mode—Time spent in user mode executing VAX–11 instructions
- Compatibility Mode—Time spent executing compatibility mode instructions
- Idle Time—Time spent executing the NULL process

EXAMPLE

```
MONITOR> MONITOR MODES /PERCENT
```

```
                    VAX/VMS Monitor Utility
                    TIME IN PROCESSOR MODES (%)
          +------+        on node SAMPLE
          | CUR |       15-MAY-1986  22:52:42
          +------+

                              0%        25%       50%       75%      100%
                              + - - - - + - - - - + - - - - + - - - - -+
Interrupt Stack             4 |*
                              |         |         |         |          |
Kernel Mode                 6 |**
                              |         |         |         |          |
Executive Mode              2 |
                              |         |         |         |          |
Supervisor Mode               |
                              |         |         |         |          |
User Mode                  72 |**************************
                              |         |         |         |          |
Compatibility Mode            |
                              |         |         |         |          |
Idle Time                  16 |******
                              |         |         |         |          |
                              + - - - - + - - - - + - - - - + - - - - -+
```

This display shows that, over the last collection interval, the processor spent 72% of its time executing user code, 8% executing system code to service user requests in executive and kernel modes, and 4% processing interrupts on the interrupt stack; it was idle 16% of the time. Time spent executing VAX RMS code is included in executive mode time. Time spent executing DCL code is included in supervisor mode time. The majority of interrupt stack time is devoted to processing buffered I/O requests.

If you omit the /PERCENT qualifier or specify /NOPERCENT, MONITOR displays mode times as rates of clock ticks per second, where a clock tick is 10 milliseconds.

For a VAX–11/782 attached processor configuration, the MODES display consists of 14 items representing the 7 modes for each of the 2 processors. If you specify /NOCPU on such a system, only the 7 modes are displayed, where each mode includes the total time for both processors. On a single-processor system, the /CPU qualifier has no effect. Also, for a multifile summary, the qualifier has no effect (the non-processor-specific form is used).

MONITOR PAGE

The MONITOR PAGE command initiates monitoring of the PAGE class.

FORMAT

MONITOR PAGE

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The PAGE class includes the following data items:

- Page Fault Rate—Rate of page faults for all working sets
- Page Read Rate—Rate of pages read from disk as a result of page faults
- Page Read I/O Rate—Rate of read I/O operations from disk as a result of page faults
- Page Write Rate—Rate at which pages were written to the page file
- Page Write I/O Rate—Rate of write I/O operations to the page file
- Free List Fault Rate—Rate at which pages were read from the free page list as a result of page faults

- Modified List Fault Rate—Rate of pages read from the modified page list as a result of page faults
- Demand Zero Fault Rate—Rate at which zero-filled pages were allocated as a result of page faults
- Global Valid Fault Rate—Rate of page faults for pages that are not in the process's working set but are in physical memory and are indicated as valid pages in the systemwide global page tables
- Writes In Progress Fault Rate—Rate of pages read that were in the process of being written back to disk, when faulted
- System Fault Rate—Rate of page faults for pages in system space
- Free List Size—Number of pages on the free page list
- Modified List Size—Number of pages on the modified page list

EXAMPLE

```
MONITOR> MONITOR PAGE

                    VAX/VMS Monitor Utility
                PAGE MANAGEMENT STATISTICS
                      on node SAMPLE
                  15-MAY-1986 22:22:44

                                CUR       AVE       MIN       MAX

Page Fault Rate               26.82     18.27      9.66     26.82
Page Read Rate                 3.97      2.65      1.33      3.97
Page Read I/O Rate             1.32      0.99      0.66      1.32
Page Write Rate                0.00      0.00      0.00      0.00
Page Write I/O Rate            0.00      0.00      0.00      0.00

Free List Fault Rate          13.90     10.96      8.00     13.90
Modified List Fault Rate       5.62      2.99      0.33      5.62
Demand Zero Fault Rate         4.63      2.65      0.66      4.63
Global Valid Fault Rate        1.32      0.66      0.00      1.32
Wrt In Progress Fault Rate     0.00      0.00      0.00      0.00
System Fault Rate              2.31      1.99      1.66      2.31

Free List Size              3164.00   3176.00   3164.00   3188.00
Modified List Size           155.00    131.00    107.00    155.00
```

This example shows that the current rate of pages read per read I/O operation is approximately 3 per second (Page Read Rate divided by Page Read I/O Rate). Note that while the page fault rate is currently at the highest point of the monitoring session, the vast majority of the pages are faulted from memory, not from disk.

MONITOR POOL

The MONITOR POOL command initiates monitoring of the POOL class, which measures space allocations in the nonpaged dynamic pool.

FORMAT

MONITOR POOL

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL
Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE
Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT
Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM
Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM
Selects minimum statistics to be displayed in a bar-graph for display and summary output.

DESCRIPTION

The POOL class includes the following data items:

- SRPs Available—Number of small request packets available in the SRP queue
- SRPs In Use—Number of small request packets available in use
- IRPs Available—Number of intermediate request packets available in the IRP queue
- IRPs In Use—Number of intermediate request packets available in use
- LRPs Available—Number of large request packets available in the LRP queue
- LRPs In Use—Number of large request packets in use

- Dynamic Bytes Available—Number of dynamic bytes available
- Dynamic Bytes In Use—Number of dynamic bytes in use
- Holes In Pool—Unused blocks of contiguous space in the dynamically allocated portion of the pool
- Largest Block—Size in bytes of the largest block of unused space in the dynamically allocated portion of the pool
- Smallest Block—Size in bytes of the smallest block of unused space in the dynamically allocated portion of the pool
- Blocks Less or Equal 32 Bytes—Blocks less than or equal to 32 bytes in size in the dynamically allocated portion of the pool

EXAMPLE

```
MONITOR> MONITOR/RECORD POOL/MINIMUM

                    VAX/VMS Monitor Utility
          +-----+   NONPAGED POOL STATISTICS
          | MIN |        on node SAMPLE
          +-----+     15-MAY-1986 10:22:39

                           0K        25K       50K       75K      100K
                           + - - - - + - - - - + - - - - + - - - - -+
SRPs Available              450 |
SRPs In Use                2010 |
                                |         |         |         |         |
IRPs Available               18 |
IRPs In Use                 494 |
                                |         |         |         |         |
LRPs Available                2 |
LRPs In Use                  77 |
                                |         |         |         |         |
Dynamic Bytes Available    43760 |*****************
Dynamic Bytes In Use      533264 |****************************************
Holes In Pool                72 |
Largest Block                16832 |******                                 |
Smallest Block               16 |
Blocks Less or Eq 32 Bytes   20 |
                           + - - - - + - - - - + - - - - + - - - - -+
                                                          RECORDING
```

In this example, only the minimum statistic is being displayed, but data is being recorded that could later be used to redisplay all statistics. Of particular interest in this display are the SRPs, IRPs, and LRPs Available items. If queue sizes for these preallocated packets drop to 0 at any time, extra overhead is incurred by the subsystems requiring these packets. Initial queue sizes of these items are determined by system parameters that can be adjusted at boot time.

MONITOR PROCESSES

The MONITOR PROCESSES command initiates monitoring of the PROCESSES class, which displays information on all processes in the system.

FORMAT

MONITOR PROCESSES

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/TOPBIO
Specifies that a bar-graph listing the top buffered I/O users be produced instead of the standard display and summary output. Values are expressed in units of buffered I/Os per second.

/TOPCPU
Specifies that a bar-graph listing the top CPU time users be produced instead of the standard display and summary output. Values are expressed in units of clock ticks (10 milliseconds) per second.

/TOPDIO
Specifies that a bar-graph listing the top direct I/O users be produced instead of the standard display and summary output. Values are expressed in units of direct I/Os per second.

/TOPFAULT
Specifies that a bar-graph listing the top page faulting processes be produced instead of the standard display and summary output. Values are expressed in units of page faults per second.

DESCRIPTION

As illustrated in the examples, the PROCESSES display (and summary) formats are different from those of all other classes. The PROCESSES display provides the following information:

- PID—Process identification as assigned by the system, in hexadecimal
- STATE—Process's scheduler state (See the description of the MONITOR STATES command for an explanation of the STATES codes.)
- PRI—Current (as opposed to base) priority of the process
- NAME—Process name
- PAGES—Number of shareable pages and total number of pages currently in use by the process
- DIOCNT—Cumulative direct I/O operations performed by the process since its creation; not displayed if the process is swapped out

- FAULTS—Cumulative page faults since the process was created; not displayed if process is swapped out
- CPU TIME—Cumulative CPU time used by the process since its creation, in the format hours:minutes:seconds; not displayed if process is swapped out

The top corners of the display contain the number of processes in the system and the time in days, hours, minutes, and seconds since the system was last booted. Processes that are swapped out are so noted.

If more processes are in the system than can be displayed on the terminal screen at once, the full display occurs in screenfuls, presented one at a time with each display separated by an interval specified with the /VIEWING_TIME qualifier. Note that the four /TOP bar-graph displays provide only the PID and process name of each of the top eight users.

As with the other bar-graph displays, examples in the displays of top users are truncated to the nearest whole number. Up to eight processes with nonzero values are displayed. To be eligible for inclusion in the list of top users, a process must be present and swapped in at the beginning and end of the display interval. This eligibility requirement also applies to the beginning and ending of the entire period covered by a summary.

Note that only one of the displays of top users or the regular PROCESSES display can be selected in a single MONITOR request.

EXAMPLES

1

```
MONITOR> MONITOR/INPUT=PROCS.DAT/INTERVAL=6 PROCESSES
Process Count: 20          VAX/VMS Monitor Utility          Uptime:    1 23:26:10
                                   PROCESSES
                                 on node SAMPLE
                              15-MAY-1986 12:39:09

      PID   STATE PRI   NAME          PAGES      DIOCNT  FAULTS  CPU TIME
 00000080 COM     0 NULL            0/0             0       0 19:43:13.8
 00000081 HIB    16 SWAPPER         0/0             0       0 00:00:15.8
 00000102 LEFO    4 SAMPLE1001      87/232      SWAPPED OUT
 00000103 COM     4 SAMPLE1101      16/100       7127   51298 00:05:11.0
 00000084 HIB     8 ERRFMT          64/174       2750     125 00:00:43.9
 00000086 LEF     8 OPCOM           73/272        283     178 00:00:07.7
 00000087 HIB     9 JOB_CONTROL     57/293        707     167 00:00:10.5
 00000088 HIB     8 CONFIGURE       43/205         22     123 00:00:00.6
 0000008A HIB     6 SYMBIONT_0001   5/56           50     617 00:03:15.1
 0000008B HIB     8 JNLACP          75/580      15149    4922 00:21:51.1
 0000008C HIB     8 NETACP          5/954          11    1057 00:25:06.8
 0000008D HIB     5 EVL             7/56           44   34384 00:00:20.5
 0000008E HIB     9 REMACP          5/54           13     107 00:00:01.3
 00000112 COM     4 SAMPLE1601      45/111      13131   39992 00:06:39.1
 0000011E CUR     9 SMITH           89/298        138     830 00:00:07.1
PLAYBACK
```

This example illustrates a PROCESSES display generated from the input file PROCS.DAT. One line is displayed for each process in the system. Note that this display shows current values only—average, minimum, and maximum statistics are not available. Also note that for swapped-out processes, the words SWAPPED OUT replace the three rightmost items, because those items are not available for swapped-out processes. Since this example is a playback request, the system uptime displayed is that of the system at the time the MONITOR data was recorded.

Nondisplayable characters in process names are represented by periods.

```
2  MONITOR> MONITOR/TOPDIO/INPUT=PROCS.DAT PROCESSES

                              VAX/VMS Monitor Utility
                          TOP DIRECT I/O RATE PROCESSES
                                  on node SAMPLE
                              15-MAY-1986 16:13:38

                                        0         25        50        75       100
                                        +-----+-----+-----+-----+-----+-----+-----+
00000C7   SAMPLE0901                25  |**********
                                        |           |           |           |           |
00000112  SAMPLE1601                17  |******
                                        |           |           |           |           |
00000102  SAMPLE1001                14  |*****
                                        |           |           |           |           |
00000103  SAMPLE1101                12  |****
                                        |           |           |           |           |
00000080  NULL                      12  |****
                                        |           |           |           |           |
0000011E  SMITH                      4  |*
                                        |           |           |           |           |
0000008C  NETACP                     1  |
                                        |           |           |           |           |
                                        |
                                        +-----+-----+-----+-----+-----+-----+-----+
PLAYBACK
```

This example shows that the process SAMPLE0901, with a rate of 25 per second, was the top consumer of direct I/Os during the most recent interval between displays.

MONITOR SCS

The MONITOR SCS command initiates monitoring of the SCS (System Communication Services) class.

FORMAT

MONITOR SCS

command qualifiers

/qualifier[,...]

One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL

Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE

Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT

Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/ITEM=(keyword[,...])

Selects one or more data items for inclusion in display and summary output. If you specify two or more keywords, enclose them in parentheses and separate them with commas. When the /ITEM qualifier is omitted, the default is /ITEM=KB_MAP.

/MAXIMUM

Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM

Selects minimum statistics to be displayed in a bar-graph for display and summary output.

/[NO]PERCENT

Controls whether statistics are expressed as percent values in display and summary output. The /PERCENT qualifier is applicable only to the DISK, MODES, SCS, and STATES classes. By default, statistics are not expressed as percent values.

/ITEM Qualifier Keywords

ALL
Specifies that statistics on all data items collected for the disks are displayed on successive screens.

BUFFER_DESCRIPTOR
Specifies that statistics on the queued-for-buffer-descriptor (on the local node) rate are displayed for each node.

D_DISCARD
Specifies that datagram discard rate statistics are displayed for each node.

D_RECEIVE
Specifies that datagram receive rate statistics are displayed for each node.

D_SEND
Specifies that datagram send rate statistics are displayed for each node.

KB_MAP
Specifies that kilobyte map rate statistics are displayed for each node.

KB_REQUEST
Specifies that kilobyte request (via request datas) rate statistics are displayed for each node.

KB_SEND
Specifies that kilobyte send (via send datas) rate statistics are displayed for each node.

M_RECEIVE
Specifies that message receive rate statistics are displayed for each node.

M_SEND
Specifies that message send rate statistics are displayed for each node.

REQUEST_DATA
Specifies that request data (initiated on the local node) rate statistics are displayed for each node.

SEND_CREDIT
Specifies that queued-for-send-credit (on the local node) rate statistics are displayed for each node.

SEND_DATA
Specifies that send data (initiated on the local node) rate statistics are displayed for each node.

DESCRIPTION

The SCS class is a component class. Data items for this class are collected for each node in the cluster. The SCS class consists of the following data items:

- Datagram Send Rate—Rate at which datagrams are sent to another node.
- Datagram Receive Rate—Rate at which datagrams are received from another node.

- Datagram Discard Rate—Rate at which datagrams are discarded by the Cluster Interconnect (CI) port driver. Datagrams are discarded by the CI port driver when a receive buffer is not available. Datagrams can also be discarded by the CI port hardware, but this is not reflected by the Datagram Discard Rate.
- Message Send Rate—Rate at which sequenced messages are sent to another node. Sequenced messages are exchanged between nodes to communicate with Mass Storage Control Protocol (MSCP) disks and the lock manager.
- Message Receive Rate—Rate at which sequenced messages are received from another node. Sequenced messages are exchanged between nodes to communicate with MSCP disks and the lock manager.
- Send Data Rate—Rate at which block send datas are initiated on the local node.
- Kbytes Send Rate—Rate at which kilobytes are sent, as a result of send datas initiated on the local node.
- Request Data Rate—Rate at which request datas are initiated on the local node.
- Kbytes Request Rate—Rate at which kilobytes are received, as a result of request datas initiated on the local node.
- Kbytes Map Rate—Rate at which kilobytes are mapped for block transfers. This is a rough measure of the data transfer rate between the local node and a remote node. Before any transfer can take place, a buffer must be mapped. The size of the accumulated buffers that were mapped is displayed by the Kbytes Map Rate. If request datas or send datas are initiated on the local or a remote node, then the Kbytes Map Rate reflects the number of kilobytes actually transferred between the two nodes.
- Send Credit Queued Rate—Rate at which connections are queued for a send credit. A connection is queued for a send credit whenever all of the buffers that were allocated by the remote node have been used.
- Buffer Descriptor Queued Rate—Rate at which connections are queued for a buffer descriptor. A connection is queued for a buffer descriptor whenever all of the buffer descriptors have been allocated by the local node. You can increase the number of buffer descriptors allocated on the local system by adjusting the system parameter SCSBUFFCNT.

EXAMPLE

```
MONITOR> MONITOR SCS

                    VAX/VMS Monitor Utility
                        SCS STATISTICS
                        on node CURLEY
                    15-MAY-1986 10:21:46

Kbytes Map Rate              CUR       AVE       MIN       MAX
CURLEY                      0.00      0.00      0.00      0.00
MOE                         0.00      0.00      0.00      0.00
LARRY                       0.00      0.00      0.00      0.00
SHEMP                       5.64      3.81      1.98      5.64
```

The command in this example requests that kilobyte map rate statistics collected for SCS be displayed for each node in the VAXcluster. The display shows block transfer map activity between the node CURLEY and

the Hierarchical Storage Controller (HSC) SHEMP. Note that each node in the VAXcluster is identified by its SCS node name.

MONITOR STATES

The MONITOR STATES command initiates monitoring of the PROCESS STATES class, which shows the number of processes in each of the 14 scheduler states.

FORMAT MONITOR STATES

command qualifiers

/qualifier[,...]

One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL

Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE

Selects average statistics to be displayed in a bar-graph for display and summary output.

/CURRENT

Selects current statistics to be displayed in a bar-graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM

Selects maximum statistics to be displayed in a bar-graph for display and summary output.

/MINIMUM

Selects minimum statistics to be displayed in a bar-graph for display and summary output.

/[NO]PERCENT

Controls whether statistics are expressed as percent values in display and summary output. The /PERCENT qualifier is applicable only to the DISK, MODES, SCS, and STATES class names. By default, statistics are not expressed as percent values.

DESCRIPTION

The STATES class shows the number of processes in each of the 14 scheduler states as follows:

- Collided Page Wait (COLPG)—Waiting for a faulted page in transition
- Mutex & Miscellaneous Resource Wait (MWAIT)—Waiting for the availability of a mutual exclusion semaphore or a dynamic resource. Following is a summary of Mutex and Miscellaneous Resource Wait states and identifying codes, as they appear in the PROCESSES class display.

Resource Wait Code	Reason for Wait
RWAST	AST wait (wait for system or special kernel AST)
RWBRK	Breakthrough (wait for broadcast message)
RWCLU	Cluster state transition wait
RWIMG	Image activation lock
RWLCK	Lock data base
RWMBX	Mailbox full
RWMPB	Modified page writer busy
RWMPE	Modified page list empty
RWNPG	Nonpaged dynamic memory
RWPAG	Paged dynamic memory
RWPGF	Page file full
RWQUO	Job quota
RWSCS	System Communication Services wait
RWSWP	Swap file space

- Common Event Flag Wait (CEF)—Waiting for some combination of event flags to be set in a common event block
- Page Fault Wait (PFW)—Waiting for a page to be read as a result of a page fault; resident processes
- Local Event Flag Wait (LEF)—Waiting for one or more local event flags to be posted; resident processes
- Local Event Flag (Outswapped) (LEFO)—Waiting for one or more local event flags to be posted; outswapped processes
- Hibernate (HIB)—Hibernating, or process has executed a hibernate request; resident processes
- Hibernate (Outswapped) (HIBO)—Hibernating, or process has executed a hibernate request; outswapped processes
- Suspended (SUSP)—Process has executed a suspend request; resident processes
- Suspended (Outswapped) (SUSPO)—Process has executed a suspend request; outswapped processes
- Free Page Wait (FPW)—Waiting for a free page of memory

- Compute (COM)—Ready to use the processor; resident processes
- Compute (Outswapped) (COMO)—Ready to use the processor; outswapped processes
- Current Process (CUR)—Using the processor

The data items can also be displayed as percentages of all processes.

Note that the Current Process is always the process running MONITOR, since MONITOR is running when each measurement is made. Local Event Flag Wait (Outswapped) processes normally belong to interactive users who have been prompted but have not responded, although they might be processes waiting for disk I/O on a crowded system. A state of Compute (Outswapped) for any process indicates a very crowded system.

For performance reasons, MONITOR does not synchronize the scanning of process state data structures with operating system use of those structures. It is therefore unlikely that MONITOR will display certain anomalous state indications.

EXAMPLE

```
$ MONITOR/INPUT/SUMMARY/NODISPLAY -
$_/BEGINNING=15-MAY-1985:13:00 -
$_/ENDING=15-MAY-1985:14:00 STATES/PERCENT/ALL
$ TYPE MONITOR.SUM

                    VAX/VMS Monitor Utility
                        PROCESS STATES (%)
                        on node SAMPLE        From: 15-MAY-1986 13:00:00
                           SUMMARY            To:   15-MAY-1986 14:00:00

                              CUR%       AVE%       MIN%       MAX%
Collided Page Wait             0.0        0.0        0.0        0.0
Mutex & Misc Resource Wait     0.0        0.0        0.0        0.0
Common Event Flag Wait         0.0        0.0        0.0        0.0
Page Fault Wait                4.3        1.4        0.0        4.3
Local Event Flag Wait         34.7       31.7       34.7       42.8
Local Evt Flg (Outswapped)     0.0        9.0        0.0       19.4
Hibernate                     43.4       40.7       43.4       52.1
Hibernate (Outswapped)         0.0        4.3        0.0       15.4
Suspended                      0.0        0.0        0.0        0.0
Suspended (Outswapped)         0.0        0.0        0.0        0.0
Free Page Wait                 0.0        0.0        0.0        0.0
Compute                       13.0        7.3        4.3       13.0
Compute (Outswapped)           0.0        0.8        0.0        3.2
Current Process                4.3        4.4        4.3        4.7
PLAYBACK                  SUMMARIZING
```

The commands in this example generate and display a PROCESS STATES summary. Note that since use of the RETURN key is not permitted within a single MONITOR command following the MONITOR> prompt, the MONITOR command is issued at DCL level. The summary shows that on the average 14.1% of processes were swapped out for the summarized period. Note that the summary was requested for data covering only the hour between 1 P.M. and 2 P.M., although the input file could have contained data covering a longer period.

MONITOR SYSTEM

The MONITOR SYSTEM command initiates monitoring of the SYSTEM statistics class, which shows several of the most important items from other classes.

FORMAT MONITOR SYSTEM

command qualifiers

/qualifier[,...]

One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/ALL

Specifies that a table of all available statistics (current, average, minimum, and maximum) is to be included in the display and summary output. For summary output, this qualifier is the default for all classes; otherwise, it is the default for all classes except CLUSTER, MODES, PROCESSES, STATES, and SYSTEM.

/AVERAGE

Selects average statistics to be displayed in a bar graph for display and summary output.

/CURRENT

Selects current statistics to be displayed in a bar graph for display and summary output. The /CURRENT qualifier is the default for the CLUSTER, MODES, STATES, and SYSTEM classes.

/MAXIMUM

Selects maximum statistics to be displayed in a bar graph for display and summary output.

/MINIMUM

Selects minimum statistics to be displayed in a bar graph for display and summary output.

DESCRIPTION

Because the SYSTEM class collects the most significant performance statistics from other classes in a single display, it is particularly useful to system managers and other users seeking a general overview of system activity. The SYSTEM class includes the following data items:

Interrupt Stack
Kernel Mode
Executive Mode
Supervisor Mode
User Mode
Compatibility Mode
Idle Time
Process Count
Page Fault Rate

Page Read I/O Rate
Free List Size
Modified List Size
Direct I/O Rate
Buffered I/O Rate

Two display formats are provided, depending on the class-name qualifier specified:

- A tabular style format for the /ALL qualifier
- A bar-graph style format for the /AVERAGE, /CURRENT, /MAXIMUM, and /MINIMUM qualifiers

Note that the bar-graph version of the SYSTEM class (shown in Example 2) contains somewhat different data from the tabular version:

- All of the CPU processor modes except Idle Time are summed in the CPU Busy segment.
- In the Page Fault segment, the page read I/O rate is indicated by a vertical bar. The bar provides a visual estimate of the proportion of the total page fault rate which caused read I/O operations (the "hard" fault rate). The "hard" fault rate appears to the left of the bar.
- Four segments show the processes which are currently (since the last screen update) the top consumers of CPU, page faults, direct I/Os, and buffered I/Os. Note that the NULL process is never displayed, even if it is a top consumer.

  Any process that MONITOR designates as a top user process must be swapped in at the beginning and end of the display interval, or at the beginning and ending of the entire period covered by a summary.

  When the upper bar graph (top user) and the corresponding lower bar graph (overall system measure) are tracking the same statistic for the same interval (as in Example 2), it is reasonable to compare the two graphs. This will be the case whenever

  — SYSTEM is the only class being monitored (no other class names have been specified with the MONITOR command).

  — The CURRENT statistic is specified.

  — The /INTERVAL and /VIEWING_TIME values are equal.

  Otherwise, you should exercise care in making such comparisons for the following reasons:

  — The top user statistic is always CURRENT, while the overall system measure statistic may be CURRENT, AVERAGE, MAXIMUM, or MINIMUM.

  — Rates for top users are calculated based on the interval between two successive screen displays, while overall system rates are based on the collection interval. These two interval values can be different whenever one or more classes are being monitored with the SYSTEM class, or when /INTERVAL and /VIEWING_TIME values differ.
- While other upper boundary figures for the SYSTEM class bar graphs are constants, the figures for Free List Size and Modified List Size are derived from the physical memory configuration and system parameters of individual systems. The upper boundary figure for the Free List is the number of pages available after deducting the pages permanently allocated

to the VAX/VMS operating system. This figure, sometimes referred to as "balance set memory," is the number of pages that can be allocated to processes, the Free List, and the Modified List. The upper boundary figure for the Modified List is the value of the MPW_HILIMIT system parameter. Note that both upper boundary figures are calculated when the MONITOR request is initiated and do not change thereafter.

EXAMPLES

1

```
MONITOR> MONITOR SYSTEM/ALL

                              VAX/VMS Monitor Utility
                                SYSTEM STATISTICS
                                  on node SAMPLE
                              15-MAY-1986 12:43:28

                                    CUR        AVE        MIN        MAX

  Interrupt Stack                  0.33       0.33       0.33       0.33
  Kernel Mode                      0.16       0.16       0.16       0.16
  Executive Mode                   0.00       0.00       0.00       0.00
  Supervisor Mode                  0.00       0.00       0.00       0.00
  User Mode                        0.50       0.49       0.50       0.50
  Compatibility Mode               0.00       0.00       0.00       0.00
  Idle Time                       99.00      98.67      99.00      99.00

  Process Count                   14.00      14.00      14.00      14.00
  Page Fault Rate                  0.33       0.33       0.33       0.33
  Page Read I/O Rate               0.00       0.00       0.00       0.00
  Free List Size                4255.00    4255.00    4255.00    4255.00
  Modified List Size             105.00     105.00     105.00     105.00
  Direct I/O Rate                  0.00       0.00       0.00       0.00
  Buffered I/O Rate                0.16       0.16       0.16       0.16
```

This example shows the tabular style format for the SYSTEM display.

2

```
MONITOR> MONITOR SYSTEM
Node: SAMPLE                VAX/VMS Monitor Utility     15-MAY-1986 12:38:48
Statistic: CURRENT            SYSTEM STATISTICS

                                                        Process States
          + CPU Busy (100)          -+                  LEF:     7      LEFO:     0
          |************************|                   HIB:    11      HIBO:     0
CPU     0 +------------------------+ 100                COM:     4      COMO:     0
          |********                |                    PFW:     0      Other:    1
          +------------------------+                    MWAIT:   0
          Cur Top: ASSEM_LIBRTL (34)                      Total: 23
          + Page Fault Rate (25)    -+                  + Free List Size (4604)   -+
          |**|***                    |                  |*********                 | 12K
MEMORY  0 +------------------------+ 100   0 +------------------------+
          |**                       |                  |*******                   | 500
          +------------------------+                    + Modified List Size (146) +
          Cur Top: ASSEM_SYS (11)
          + Direct I/O Rate (15)    -+                  + Buffered I/O Rate (0)   -+
          |******                   |                  |                          |
I/O     0 +------------------------+ 60    0 +------------------------+ 150
          |****                     |                  |                          |
          +------------------------+                    +------------------------+
          Cur Top: ASSEM_SYS (10)                       Cur Top: Cerb Servant (0)
```

This example shows the bar-graph style format for the SYSTEM display.

SET DEFAULT

The SET DEFAULT command sets command qualifier and class-name parameter defaults for the MONITOR command. Each time you issue the SET DEFAULT command, only the command qualifiers you specify explicitly are set. However, each new SET DEFAULT command replaces the entire set of class-name parameters.

FORMAT

SET DEFAULT *classname[,...]*

command parameters

classname[,...]
Specifies one or more class names.

command qualifiers

/qualifier[,...]
One or more qualifiers as described in the Command Qualifiers Section.

class-name qualifiers

/qualifier[,...]
One or more class-name qualifiers (see Table MON–1).

DESCRIPTION

Command and class-name qualifiers are identical to those for the MONITOR classname commands.

EXAMPLE

```
MONITOR> SET DEFAULT /INTERVAL=10 PAGE/AVERAGE+POOL/MAXIMUM
```

The command in this example selects PAGE and POOL as the default classes for the MONITOR classname command, and specifies an interval of 10 seconds for the statistics display. The command specifies that AVERAGE statistics be displayed for the PAGE class and that MAXIMUM statistics be displayed for the POOL class. After establishing these defaults, you can issue the MONITOR command without any qualifiers or parameters to display the specified results.

SHOW DEFAULT

The SHOW DEFAULT command displays the defaults established by the SET DEFAULT command.

FORMAT

SHOW DEFAULT

command parameters

None.

command qualifiers

None.

DESCRIPTION

You can use the SHOW DEFAULT command to verify the defaults you have set with the SET DEFAULT command.

EXAMPLE

```
MONITOR> SHOW DEFAULT
/BEGINNING = current time              /INTERVAL     = 10
/ENDING    = indefinite                /VIEWING_TIME = 10
/NOINPUT
/NORECORD
/DISPLAY   = SYS$OUTPUT:.;
/NOSUMMARY
/NOCOMMENT
Classes:
 PAGE/AVERAGE POOL/MAXIMUM
```

The command in this example displays the defaults specified by the previous SET DEFAULT command.

LIVE DISPLAY MONITORING EXAMPLES

The following examples illustrate the live display monitoring mode of operation. Use this mode when you want to examine the activity of a running system, either on a routine basis, or as part of an installation checkout, tuning, or trouble-shooting exercise. No historical record of output is kept.

1
```
$ MONITOR PROCESSES/TOPCPU
```

This command displays a bar graph showing the eight processes that were the top consumers of CPU time during the period between displays. It also displays the amount of CPU time each of these processes used.

2
```
$ MONITOR/DISPLAY=POOL.LOG POOL
```

MONITOR display output can be routed to any supported terminal device or to a disk file. The command in this example writes MONITOR's display of nonpaged pool statistics to the file POOL.LOG. This file could then be printed out on a hardcopy device.

3
```
$ MY_CLASSES :== -
_$ "DECNET+FCP+IO+LOCK+MODES+PAGE+POOL+PROCESSES+STATES"
$ MONITOR/NODE=(CURLEY,LARRY)/INTERVAL=20/VIEWING_TIME=8 'MY_CLASSES'
```

You may find it convenient to establish DCL symbols for frequently used combinations of class names, as in this example. Here, the MONITOR command collects selected classes of data for nodes CURLEY and LARRY every 20 seconds. Every 8 seconds, the most recently collected data for one of the classes is displayed. The ordering of the classes for display is predetermined by MONITOR.

LIVE RECORDING EXAMPLE

The following example illustrates the live recording mode of operation. Use live recording whenever you need to capture MONITOR data for future use. Possible uses include the following:

- Installation checkout, tuning, trouble-shooting—that is, all the uses listed above for live display monitoring. Choose recording over display whenever you would like to capture more classes than you could reasonably watch at a terminal, whenever a terminal is not available, or whenever you need to gather data about the system but cannot devote your time to the terminal until later.
- Routine performance data gathering for long-term analysis. MONITOR data can be recorded on a routine basis and summarized to gather data about system resource utilization over long periods of time.

```
$ MONITOR/NODE=(LARRY,MOE)/NODISPLAY/RECORD MODES+STATES
```

This command records data on the time spent in each of the processor modes and on the number of processes in each of the scheduler states for nodes LARRY and MOE. It does not, however, display this information.

CONCURRENT DISPLAY AND RECORDING EXAMPLES

The following examples illustrate the concurrent display and recording mode of operation. Use this mode whenever you want to retain performance data and watch as it is being collected.

```
1   $ MONITOR/RECORD FCP/CURRENT,POOL/MINIMUM,FCP/AVERAGE
```

This command collects and records file system ACP data and nonpaged dynamic pool data every three seconds. It also displays, in bar-graph form, average FCP statistics and minimum POOL statistics. The display alternates between the two graphs every three seconds. Note that the FCP class was requested twice; while this is a misuse of the MONITOR command, it is not flagged as an error. Since MONITOR allows only one statistic qualifier per class name, only the later specification (/AVERAGE) is used. Current statistics can be obtained in a subsequent playback request.

Another method of performing concurrent display and recording uses two separate processes, one for recording and one for display. The display process plays back the recording file as it is being written (possible because MONITOR allows shared read access to the recording file).

The next example shows how one process (Process A) can perform recording, while another process (Process B) plays back the file to obtain a summary.

Process A issues the following command:

```
2   $ MONITOR/RECORD=SYS$MANAGER:ARCHIVE.DAT: -
_$ /INTERVAL=300/NODISPLAY ALL_CLASSES)
```

Process A uses this command to archive data for all classes once every three minutes. System managers may find it convenient to place a similar command in their system startup command file.

Process B now issues the command:

```
$ MONITOR/INPUT=SYS$MANAGER:ARCHIVE.DAT: -
_$ /NODISPLAY/SUMMARY/BEGINNING="-1" PAGE,IO)
```

Using this command, Process B obtains a summary of page and I/O activity that occurred during the previous hour, perhaps as part of an investigation of a reported performance problem. Note that since Process A, while recording, executes an RMS flush operation every five minutes, up to five minutes of the most recently collected data will not be available to process B. The time between flush operations can be specified explicitly with the /FLUSH_INTERVAL qualifier. Note also that Process B must have read access to the recording file.

PLAYBACK EXAMPLES

The following examples illustrate the playback mode of operation. Use playback of a recording file to obtain terminal output and/or summary reports of all or just a subset of collected data. Data can be subsetted by class or time segment. For example, if several classes of data have been collected for an entire day, you can examine or summarize the data on any one or more of the classes during any time period in that day. You can also display or summarize data with a different interval than that at which it was recorded. The actual amount of time between displays of screen images is controlled with the /VIEWING_TIME qualifier.

1

```
$ MONITOR/RECORD/INTERVAL=5 IO
   .
   .
   .
$ MONITOR/INPUT IO
```

These commands produce system I/O statistics. The first command gathers and displays data every five seconds, beginning when the command is issued and ending when the user issues a CTRL/C. In addition, it records binary data in the default output file MONITOR.DAT. The second command plays back the I/O statistics display, using the data in MONITOR.DAT for input. The default viewing time for the playback is three seconds, but each screen display represents five seconds of monitored I/O statistics.

2

```
$ MONITOR/RECORD/NODISPLAY -
_$ /BEGINNING=08:00:00 -
_$ /ENDING=16:00:00 -
_$ /INTERVAL=120 POOL
   .
   .
   .
$ MONITOR/INPUT/DISPLAY=HOURLY.LOG -
_$ /INTERVAL=3600 POOL
```

This sequence of commands illustrates the recording of data with a relatively small interval and playback with a relatively large interval. This is useful for producing average, minimum, and maximum statistics that cover a wide range of time, but have greater precision than they would have if they had been gathered using the larger interval.

The first command records data on space allocation in the nonpaged dynamic pool for the indicated eight-hour period, using an interval of two minutes. The second plays the data back with an interval of one hour, storing display output in the file HOURLY.LOG. This file can then be typed or printed to show the cumulative pool utilization at each hour throughout the eight-hour period.

3

```
$ MONITOR/INPUT/NODISPLAY/SUMMARY=DAILY.LOG POOL/AVERAGE
```

This command uses the recording file created in the previous example to produce a one-page summary report file showing the average statistics for the indicated eight-hour period. The summary report has the same format as a screen display, which in this case is a bar graph.

REMOTE PLAYBACK EXAMPLE

You can collect MONITOR data from any system to which your system has a DECnet connection. You can then display the data "live" on your local system. To implement the procedure, follow these steps:

1 In the default DECNET directory on each remote system, create a file, MONITOR.COM, similar to the following:

```
$ !
$ !    * Enable MONITOR remote playback *
$ !
$ MONITOR /NODISPLAY/RECORD=SYS$NET ALL_CLASSES
```

2 On your local system, define a logical name, as follows, for the remote system from which you wish to collect data:

```
$ DEFINE remotenodename_mon "node::""task=monitor"""
```

You may want to define, in a login command procedure, a series of such logical names for the various systems you wish to access.

To display the remote MONITOR data as it is being collected, issue a command of the form:

```
$ MONITOR/INPUT=remotenodename_mon classnames
```

You may also place MONITOR.COM files in directories other than the default DECNET directory and use access control strings and/or proxy accounts to invoke these command files remotely.

When you invoke MONITOR on your local system, a process is created on the remote system which executes the MONITOR.COM command file. The remote system will therefore experience some associated CPU and DECnet overhead. You can regulate the overhead in the MONITOR.COM file through the use of the /INTERVAL qualifier and the list of class names.

RERECORDING EXAMPLE

The following example illustrates the rerecording mode of operation.

Rerecording is a combination of playback and recording. It can be useful for data reduction of recording files. When you play back an existing recording file, all MONITOR options are available to you; thus, you can choose to record a subset of the recorded classes and/or a subset of the recorded time segment and even a larger interval value.

All these techniques produce a new, smaller recording file, at the expense of some of the recorded data. A larger interval value reduces the volume of the collected data, so that displays and summary output produced from the newer recorded file will be less precise. Note that average rate values will not be affected in this case, but average level values will be less precise (since the sample size is reduced), as will maximum and minimum values.

```
$ SUBMIT MONREC.COM
```

MONREC.COM contains the following commands:

```
$ MONITOR/NODISPLAY/RECORD/INTERVAL=60 -
        /BEGINNING=8:00/ENDING=16:00 DECNET,LOCK
$ MONITOR/INPUT/NODISPLAY/RECORD DECNET
```

The first command runs in a batch job, recording DECnet–VAX and lock management data once per minute, between the hours of 8 A.M. and 4 P.M. The second command, which is issued after the first command completes, rerecords the data by creating a new version of the MONITOR.DAT file, containing only the DECnet–VAX data.

VAXCLUSTER MULTIFILE SUMMARY EXAMPLE

This section provides an example of a procedure that you, as cluster manager, might use to create multifile summaries in a VAXcluster environment (cluster summaries). You will probably want to write your own command procedures to suit conditions at your site.

To facilitate generation of cluster summaries, and to perform other "automatic" MONITOR functions, you can create and execute command files similar to those illustrated in the accompanying procedure (and supplied in SYS$EXAMPLES). Note that you must define the logical names SYS$MONITOR and MON$ARCHIVE in SYSTARTUP.COM before executing any of the command files.

To produce a cluster summary, create and execute command files similar to the following:

1 MONITOR.COM—Archive recording file and summary file from previous boot; initiate continuous recording for current boot

```
$ SET VERIFY
$ !
$ !  MONITOR.COM
$ !
$ !  This command file is to be placed in a cluster-accessible directory
$ !  called SYS$MONITOR and submitted at system startup time as a detached
$ !  process via SUBMON.COM.  For each node, MONITOR.COM creates, in
$ !  SYS$MONITOR, a MONITOR recording file that is updated throughout the
$ !  life of the boot. It also creates, in MON$ARCHIVE, a summary file from
$ !  the recording file of the previous boot, along with a copy of that
$ !  recording file.  Logical name definitions for both cluster-accessible
$ !  directories, SYS$MONITOR and MON$ARCHIVE, should be included in SYSTARTUP.COM.
$ !
$ SET DEF SYS$MONITOR
$ SET NOON
$ PURGE MONITOR.LOG/KEEP:2
$ !
$ !  Compute executing node name and recording and summary file names
$ !  (incorporating node name and date).
$ !
$ NODE = F$GETSYI("NODENAME")
$ SEP = ""
$ IF NODE .NES. "" THEN SEP = "_"
$ DAY = F$EXTRACT (0,2,F$TIME())
$ IF F$EXTRACT(0,1,DAY) .EQS. " " THEN DAY = F$EXTRACT(1,1,DAY)
$ MONTH = F$EXTRACT(3,3,F$TIME())
$ ARCHFILNAM = "MON$ARCHIVE:"+NODE+SEP+"MON"+DAY+MONTH
$ RECFIL = NODE+SEP+"MON.DAT"
$ SUMFIL = ARCHFILNAM+".SUM"
$ !
$ !
$ !  Check for existence of recording file from previous boot and skip
$ !  summary if not present.
$ !
```

```
$ OPEN/READ/ERROR=NORECFIL RECORDING 'RECFIL'
$ CLOSE RECORDING
$ !
$ !
$ !  Generate summary file from previous boot.
$ !
$ MONITOR /INPUT='RECFIL' /NODISPLAY /SUMMARY='SUMFIL' -
$ ALL_CLASSES+MODE/ALL+STATES/ALL+SCS/ITEM=ALL+SYSTEM/ALL+DISK/ITEM=ALL
$ !
$ !
$ !  Compute subject string and mail summary file to cluster manager.
$ !
$ !
$ A="""
$ B=" MONITOR Summary "
$ SUB = A+NODE+B+F$TIME()+A
$ MAIL/SUBJECT='SUB' 'SUMFIL' CLUSTER_MANAGER
$ !
$ !
$ !  Archive recording file and delete it from SYS$MONITOR.
$ !
$ COPY 'RECFIL' 'ARCHFILNAM'.DAT
$ DELETE 'RECFIL';*
$ !
$ NORECFIL:
$ SET PROCESS/PRIORITY=15
$ !
$ !
$ !  Begin recording for this boot.  The specified /INTERVAL value is
$ !  adequate for long-term summaries; you may require a smaller value
$ !  to get reasonable "semi-live" playback summaries (at the expense
$ !  of more disk space for the recording file).
$ !
$ MONITOR /INTERVAL=300 /NODISPLAY /RECORD='RECFIL' ALL_CLASSES
$ !
$ !
$ !  End of MONITOR.COM
$ !
```

2 SUBMON.COM—Submit MONITOR.COM as a detached process from SYSTARTUP.COM to initiate continuous recording for the current boot.

```
$ SET VERIFY
$ !
$ !  SUBMON.COM
$ !
$ !  This command file is to be placed in a cluster-accessible directory
$ !  called SYS$MONITOR.  At system startup time, for each node, it is
$ !  executed by SYSTARTUP.COM, following logical name definitions for
$ !  the cluster-accessible directories SYS$MONITOR and MON$ARCHIVE.
$ !
$ !
$ !  Submit detached MONITOR process to do continuous recording.
$ !
$ !
$ RUN   SYS$SYSTEM:LOGINOUT.EXE -
        /UIC=[1,4]              -
        /INPUT=SYS$MONITOR:MONITOR.COM  -
        /OUTPUT=SYS$MONITOR:MONITOR.LOG -
        /ERROR=SYS$MONITOR:MONITOR.LOG  -
        /PROCESS_NAME="Monitor" -
        /WORKING_SET=100 -
        /MAXIMUM_WORKING_SET=100 -
        /EXTENT=512/NOSWap
$ !
$ !
$ !  End of SUBMON.COM
$ !
```

3 MONSUM.COM—Generate daily and "prime-time" cluster summaries:

```
$ SET VERIFY
$ !
$ !  MONSUM.COM
$ !
$ !  This command file is to be placed in a cluster-accessible directory
$ !  called SYS$MONITOR and executed at the convenience of the cluster
$ !  manager.  The file generates both 24-hour and "prime time" cluster
$ !  summaries and resubmits itself to run each day at midnight.
$ !
$ SET DEF SYS$MONITOR
$ SET NOON
$ !
$ !  Compute file specification for MONSUM.COM and resubmit the file.
$ !
$ FILE = F$ENVIRONMENT("PROCEDURE")
$ FILE = F$PARSE(FILE,,,"DEVICE")+F$PARSE(FILE,,,"DIRECTORY")+F$PARSE(FILE,,,"NAME")
$ SUBMIT 'FILE' /AFTER=TOMORROW /NOPRINT
$ !
$ !  Generate 24-hour cluster summary.
$ !
$ !
$ MONITOR/INPUT=(SYS$MONITOR:*MON*.DAT;*,MON$ARCHIVE:*MON*.DAT;*) -
  /NODISPLAY/SUMMARY=MONSUM.SUM -
  ALL_CLASSES+DISK/ITEM=ALL+SCS/ITEM=ALL-
  /BEGIN="YESTERDAY+0:0:0.00" /END="TODAY+0:0:0.00" /BY_NODE
$ !
$ !
$ !  Mail 24-hour summary file to cluster manager and delete the file from
$ !  SYS$MONITOR.
$ !
$ !
$ MAIL/SUBJECT="Daily Monitor Clusterwide Summary" MONSUM.SUM CLUSTER_MANAGER
$ DELETE MONSUM.SUM;*
$ !
$ !  Generate prime-time cluster summary.
$ !
$ !
$ MONITOR/INPUT=(SYS$MONITOR:*MON*.DAT;*,MON$ARCHIVE:*MON*.DAT;*) -
  /NODISPLAY/SUMMARY=MONSUM.SUM -
  ALL_CLASSES+DISK/ITEM=ALL+SCS/ITEM=ALL-
  /BEGIN="YESTERDAY+9:0:0.00" /END="YESTERDAY+18:0:0.00" /BY_NODE
$ !
$ !
$ !  Mail prime-time summary file to cluster manager and delete the file
$ !  from SYS$MONITOR.
$ !
$ !
$ MAIL/SUBJECT="Prime-Time Monitor Clusterwide Summary" MONSUM.SUM CLUSTER_MANAGER
$ DELETE MONSUM.SUM;*
$ !
$ !  End of MONSUM.COM
$ !
```

Remember that the summary data may be extensive; you should therefore plan to print out the summary files.

A Supplemental MONITOR Information

This section describes the MONITOR recording file record formats.

A.1 The MONITOR Recording File

Binary performance data is written into the MONITOR recording file when a MONITOR request indicates recording. A record is written to this file once for each requested class per interval; the record contains a predefined set of data for each of the requested performance classes.

The recording file is created when a MONITOR request is initiated, and is closed when the request terminates. The MONITOR recording file may be used as a source file to format and display the data on a terminal, to create a summary file, or to record a new recording file with different characteristics.

Note: The record formats described in this section are subject to change without notice at any future major VAX/VMS release.

The MONITOR recording file is a VAX RMS sequential file with variable-length records. Each record in the file begins with a one-byte type field. The remaining fields are different in length and format for each record type. There are three categories of record types:

- Customer control record
- DIGITAL control record
- Class record

Customer control records may appear anywhere in the recording file. They are not generated by MONITOR and are ignored by MONITOR when it reads the file.

The first records in the MONITOR recording file, excluding customer control records, are DIGITAL control records. There are currently three types of DIGITAL control records: the file header record, the system information record, and the node transition records—one for each node.

The class records, which contain data on requested performance classes, follow the DIGITAL control records. The class record is generally written once per interval for each class being recorded. An exception to this rule is the case where several class records are required to contain data for a single class over a single interval. This case can occur for the PROCESSES class when there are too many processes to be accommodated by the maximum record size.

Unique numbers are assigned to each MONITOR record type. Record type numbers 0-127 are reserved for class records; numbers 128–191 are reserved for DIGITAL control records; numbers 192–255 are reserved for customer control records.

There are currently 23 record types generated by the Monitor Utility. Table MON–3 lists the MONITOR record types and their numbers, along with associated class types. (For an explanation of MONITOR class types, refer to Section A.4.1.)

Table MON–3 MONITOR Record Types

Record Type	Type Number (in decimal)	Class Type
File Header	128	
System Information	129	
Node Transition	130	
PROCESSES Class	0	component
STATES Class	1	system
MODES Class	2	system
PAGE Class	3	system
IO Class	4	system
FCP Class	5	system
POOL Class	6	system
LOCK Class	7	system
DECNET Class	8	system
RESERVED	9	system
RESERVED	10	system
FILE_SYSTEM_CACHE Class	11	system
DISK Class	12	component
RESERVED	13	component
DLOCK Class	14	system
SCS Class	15	component
RESERVED	16	system
SYSTEM Class	17	system
RESERVED	18	system
CLUSTER Class	19	system

A.2 Conventions

The following sections define the contents of each field within each record type. Record type and record size are given in decimal representation. References to "system time" indicate time values in system time format, that is, in 64-bit format.

The field offset names listed are not defined within the Monitor Utility. However, DIGITAL recommends that you define and use these offset names when you work with MONITOR output records.

The suggested naming convention for the field offset names appears below. Each name is of the form:

```
MNR_CCC$X_DDDDD
```

CCC is a record type or class mnemonic.

X is a one-letter code indicating the size of the data item as follows:

B for byte
W for word
L for longword
Q for quadword
O for octaword
T for ASCII string

DDDDD is the name describing the data item.

In the following tables, the size of the data is also shown in parentheses, following the description of the field contents.

A.3 DIGITAL Control Records

There are three types of DIGITAL control records: the file header record, the system information record, and the node transition record. Each file has one header record, which contains information applicable to all classes of performance data contained in the file. It must be the first record (except for customer control records) in the file.

There is one system information record per node per file. The record contains information about the VAX/VMS system being monitored and follows the header record in the file.

A.3.1 File Header Record

The file header record has a record type of 128 and a size of 515 bytes. Figure MON–1 illustrates the format of the file header record; Table MON–4 describes the fields in this record.

Figure MON–1 File Header Record Format

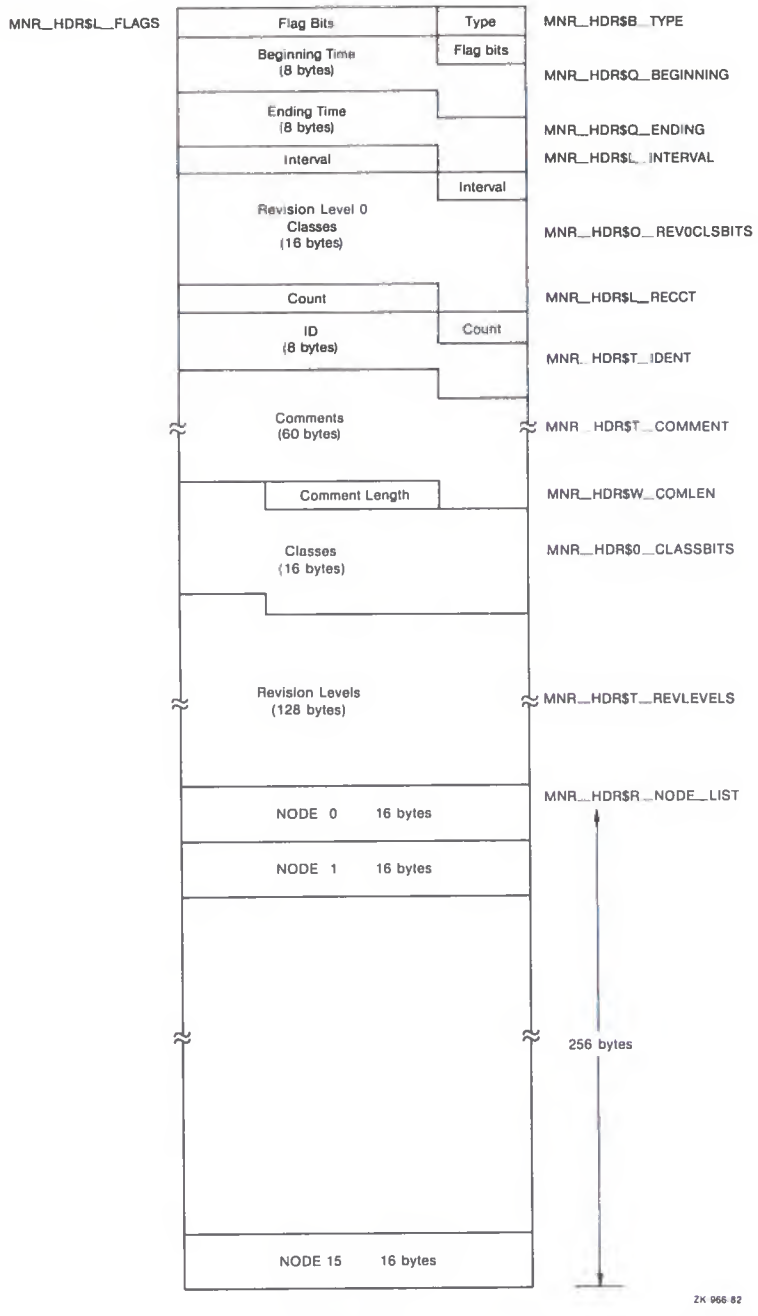


Table MON–4 Descriptions of File Header Record Fields

Field	Symbolic Offset	Contents
Type	MNR_HDR$B_TYPE	Record type identifier (1 byte)
Flags	MNR_HDR$L_FLAGS	32 flag bits; low-order bit = bit 0. All flags reserved to DIGITAL for future use (1 longword).
Beginning	MNR_HDR$Q_BEGINNING	System time of beginning of recording (1 quadword)
Ending	MNR_HDR$Q_ENDING	System time of end of recording (1 quadword)
Interval	MNR_HDR$L_INTERVAL	Interval in seconds between collections; this is the value specified by the user in the recording request. It is not necessarily equal to the exact interval value obtained by subtracting two consecutive time stamps for a given class (1 longword).
Revision Level 0	MNR_HDR$O_REV0CLSBITS	128-bit string representing all classes; a bit set to 1 indicates the presence in this file of a class which is at Revision Level 0 and whose type number corresponds to the bit number. Low-order bit = bit 0. (1 octaword). This field is provided for compatibility with Version 3.0 files.
Count	MNR_HDR$L_RECCT	Count of all records in the file (1 longword)
ID	MNR_HDR$T_IDENT	MONITOR Recording File Structure Level Identification (MON19044) (8 bytes)
Comment	MNR_HDR$T_COMMENT	Recording file description supplied by the user, including trailing blanks (60 bytes)
Comment Length	MNR_HDR$W_COMLEN	Actual length of recording file description string specified by the user (1 word)
Classes	MNR_HDR$O_CLASSBITS	128-bit string representing all classes; a bit set to 1 indicates the presence in this file of the ciass whose type number corresponds to the bit number. Low-order bit = bit 0 (1 octaword).
Revision Levels	MNR_HDR$T_REVLEVELS	128-byte string consisting of a 1-byte binary revision level number for each class. A class has a revision level of 0 initially. For each MONITOR release, if the record definition has changed, the revision level will be increased (not necessarily by 1).
Node List	MNRHDRR_NODE_LIST	Names of nodes contained within the file (256 bytes)

A.3.2 System Information Record

The system information record has a record type of 129 and a size of 43 bytes. Figure MON–2 illustrates the format of the system information record; Table MON–5 describes the fields in this record.

Figure MON–2 System Information Record Format

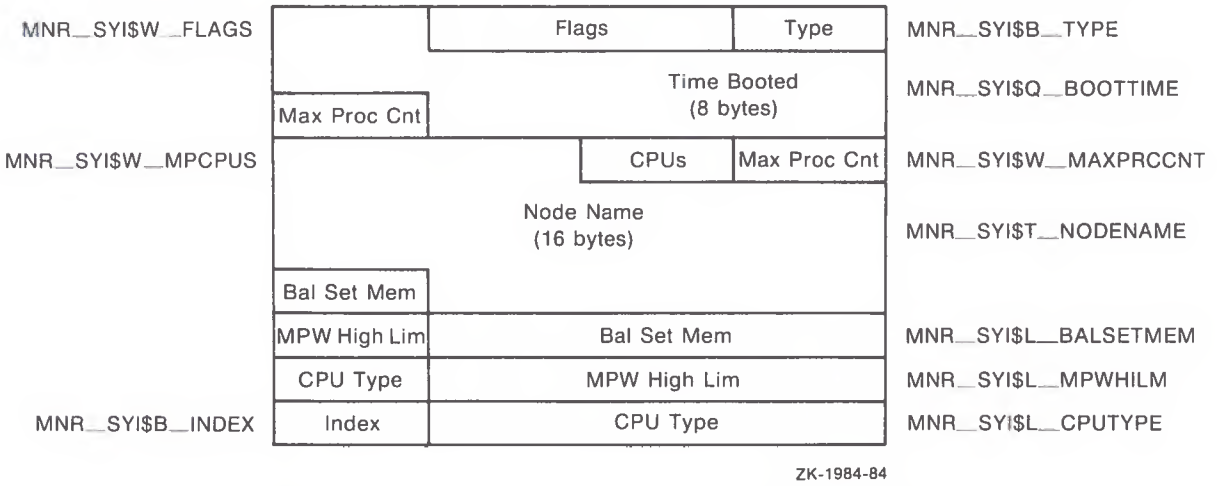


Table MON–5 Descriptions of System Information Record Fields

Field	Symbolic Offset	Contents
Type	MNR_SYI$B_TYPE	Type identifier (1 byte)
Flags	MNR_SYI$W_FLAGS	16 flag bits; low-order bit = bit 0. If bit 0 is set to 1, the node on which the data was collected is a member of a VAXcluster. All other flags reserved to DIGITAL for future use. (1 word)
Time Booted	MNR_SYI$Q_BOOTTIME	System time at which system booted (1 quadword)
Max Process	MNR_SYI$W_ MAXPRCCNT	MAXPROCESSCNT system parameter value (1 word)
CPUs	MNR_SYI$B_MPCPUS	Number of CPUs. Contains a value of 2 when the system is a VAX–11/782 attached processor system; otherwise, contains a value of 1 (1 byte)
Node Name	MNR_SYI$T_NODENAME	Node name of node being monitored (counted ASCII string, 16 bytes)
Balance Set Memory	MNR_SYI$L_ BALSETMEM	Number of process pages to which memory can be allocated (1 longword)
MPW High Limit	MNR_SYI$L_MPWHILIM	MPW_HILIMIT system parameter value (1 longword)
CPU Type	MNR_SYI$L_CPUTYPE	CPU type code. Use $PRDEF macro for code values (1 longword).
Index	MNR_SYI$B_INDEX	Identifies the position of this node in several internal MONITOR data structures (1 byte).

A.3.3 Node Transition Record

The node transition record has a record type of 130 and a size of 2 bytes. Figure MON–3 illustrates the format of the node transition record; Table MON–6 describes the fields in this record.

Figure MON–3 Node Transition Record Format

Table MON–6 Descriptions of Node Transition Record Fields

Field	Symbolic Offset	Contents
Type	MNR_NTR$B_TYPE	Record type identifier—indicates node removal operation (1 byte)
Index	MNR_NTR$B_INDEX	Identifies the position of this node in several internal MONITOR data structures (1 byte)

A.4 Class Records

The MONITOR recording file contains one class record for each requested class per collection interval, except for the PROCESSES class. (See Section A.4.2 for more information on the PROCESSES class records.) For example, if a MONITOR user requested to record five classes (excluding PROCESSES) for a duration of 100 collection intervals, the file would contain 500 class records. Class records occur in order of increasing type number within an interval. The first class record for a given interval follows the last class record for the previous interval.

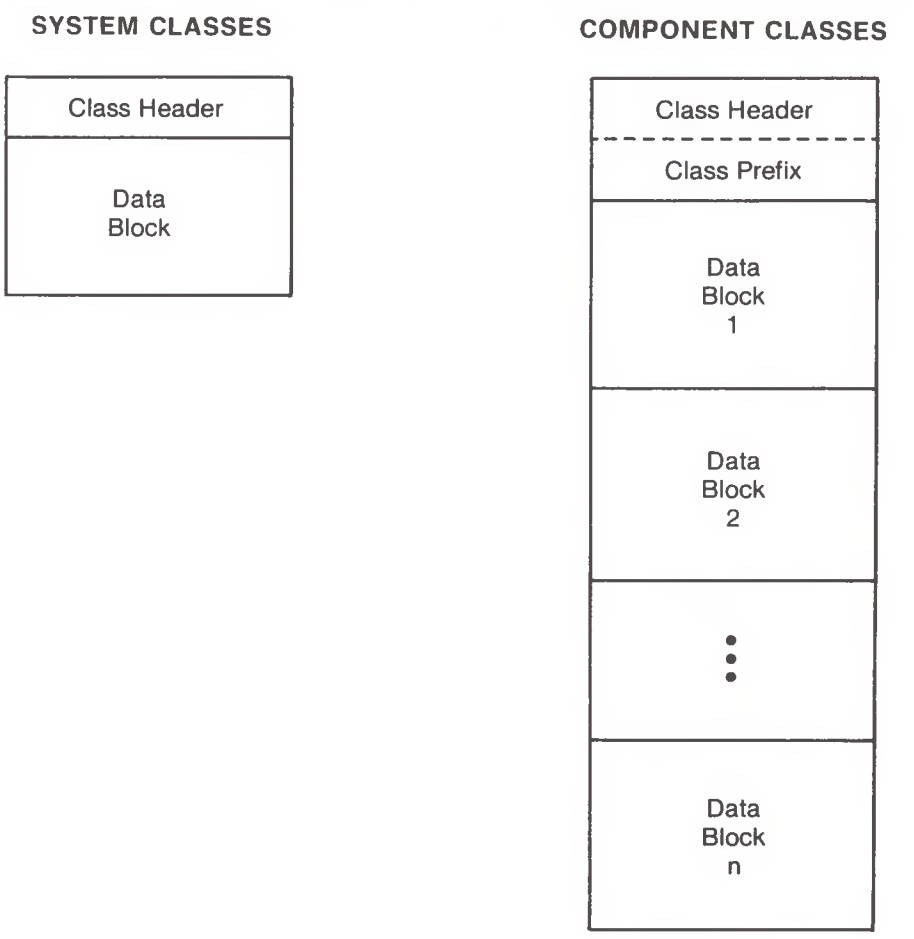
A.4.1 Class Type Formats

There are two basic class types: *system classes* and *component classes*. A class record for a system class generally consists of counts for systemwide activities (such as page faults), whereas a class record for a component class normally contains a count for each element of a measured activity (such as I/O operations for each disk in the system).

Specifically, a class record for a system class consists of a class header followed by a data block. A class record for a component class has a class header followed by a class prefix and one data block per element.

Figure MON–4 illustrates the format for class records.

Figure MON–4 Class Record Format



A.4.1.1 Class Header

The class header is the first part of every class record. Its format is independent of class. The class header is 13 bytes long.

Figure MON–5 illustrates the format of the class header; Table MON–7 describes the fields in the class header.

Figure MON–5 Class Header Format

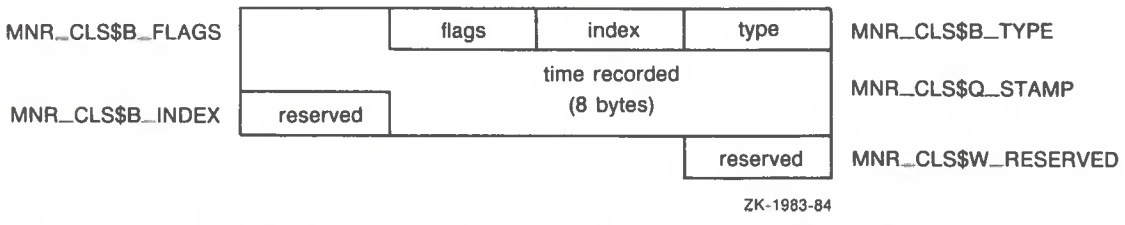


Table MON–7 Descriptions of Class Header Fields

Field	Symbolic Offset	Contents
Type	MNR_CLS$B_TYPE	Record type identifier (1 byte)
Flags	MNR_CLS$B_FLAGS	16 flag bits; low order bit = bit 0. If bit 0 is set to 1, the data for this interval continues in the next record. Can be set for the PROCESSES class only. All other flags reserved by DIGITAL for future use (I byte).
Reserved	MNR_CLS$W_RESERVED	Reserved for DIGITAL use (1 word)
Time	MNR_CLS$Q_STAMP	System time at which this class record was recorded. The time value is nondecreasing across all class records in the file.
Index	MNR_CLS$W_INDEX	Identifies the position of this node in several internal MONITOR data structures (1 word)

A.4.1.2 Class Prefix (Component Classes Only)

The class prefix always follows the class header for component class records. It contains data describing the number of elements (that is, processes for the PROCESSES class, disks for the DISK class, and so forth) represented by the class records for the current collection interval. Unlike system class records, which have one data block per record, component classes have one data block per element.

One of the class prefix data items describes the number of elements (and therefore the number of data blocks) included in the class record. The other class prefix data item is used only for the PROCESSES class, and describes the number of processes included in the interval. The following discussion applies only to the PROCESSES class.

It is possible to monitor a number of processes sufficiently large that the required number of data blocks for one collection interval will not fit into a single maximum size record. In this case, the required number of PROCESSES class records is created to fully describe the processes.

All class headers in the set of PROCESSES class records for a given interval are identical, except for the setting of bit 0 in the MNR_CLS$W_FLAGS field. This bit is set to 1 for all records except the last, for which it is set to 0.

The class prefixes in the set of class records vary, as described in Table MON–8. The contents of the MNR_CMP$L_ELTCT field depends on the number of data blocks contained in the record; the contents of the MNR_CMP$L_PCTINT field remains constant for each record in the set. All records in the set except the last contain as many data blocks as will fit into the maximum size record (32000 bytes). The last record in the set contains the remaining data blocks.

Figure MON–6 illustrates the class prefix format; Table MON–8 describes the fields in the class prefix. The class prefix is 8 bytes long.

Figure MON–6 Class Prefix Format

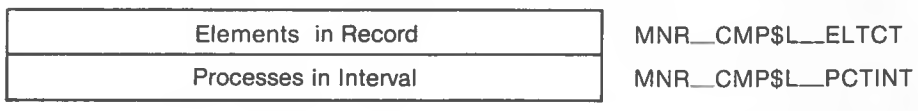


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Table MON–8 Descriptions of Class Prefix Fields

Field	Symbolic Offset	Contents
Elements In Record	MNR_CMP$L_ELTCT	Count of elements (data blocks) in this record (1 longword)
Processes In Interval	MNR_CMP$L_PCTINT	Count of processes (data blocks) for this interval (1 longword). This field is for the PROCESSES class only. For other component classes, this longword is reserved to DIGITAL for future use.

A.4.1.3 Data Block

The size and format of each data block and the number of blocks per record depend on the class. System classes have one data block per record. Component classes have one data block per element. The fields within each block are performance data items.

The following sections describe the data items within the data block for each class. Every data item falls into one of three categories. It is either a count, a level, or an informational item. A count is a numeric quantity that increases at each succeeding interval for the life of a system boot. A level is a numeric quantity that may increase or decrease at each succeeding interval. An informational item represents data that, rather than being a unit of performance measurement (as are the first two types), is descriptive in nature.

In the tables that follow, item types are identified by the letters C (count), L (level), and I (informational). The item types are shown in parentheses, following the length of the field.

A.4.2 PROCESSES Class Record

The PROCESSES class record contains data describing all processes in the system. The PROCESSES class record has a record type of 0; its size depends on the number of processes being monitored. The size, in bytes, is calculated by adding the size of the class header, the class prefix, and the data blocks contained in the record. This is shown by the following formula:

```
13 + 8 + (59 * the value of MNR_CMP$L_ELTCT)
```

Figure MON–7 illustrates the format of the PROCESSES class record. Table MON–9 describes the fields in the data block for the PROCESSES class record.

Figure MON–7 PROCESSES Class Record Format

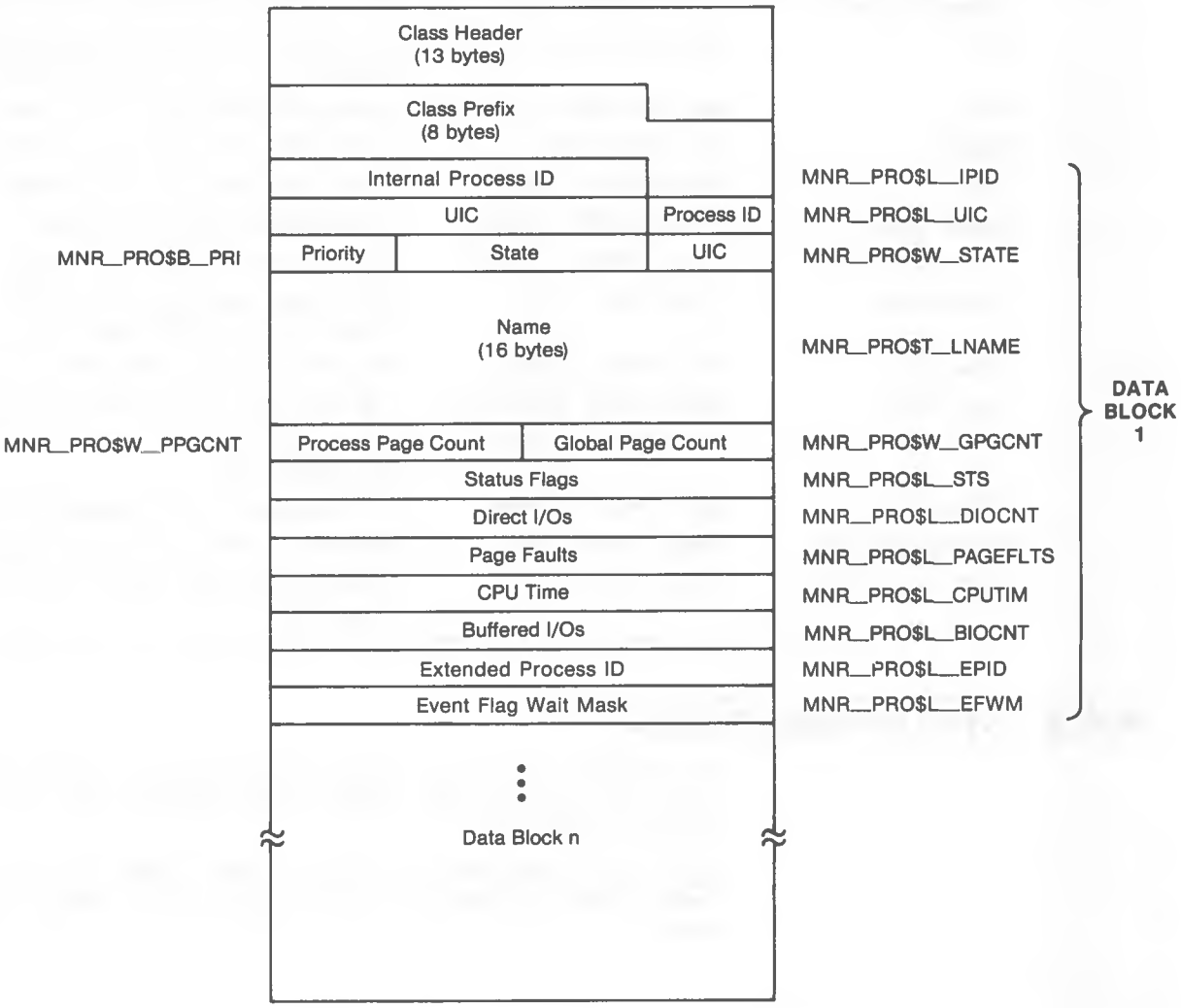

Table MON–9 Descriptions of PROCESSES Class Record Fields

Field	Symbolic Offset	Contents
Internal Process ID	MNR_PRO$L_IPID	Internal process identifcation (longword,I)
UIC	MNR_PRO$L_UIC	User identification code (Group is high-order word; Member is low-order word) (longword,I)
State	MNR_PRO$W_STATE	Current scheduling state code (word,I)
Priority	MNR_PRO$B_PRI	Current software priority (complement of 31) (byte,I)
Name	MNR_PRO$T_LNAME	Process name (counted ASCII string) (16 bytes,I)
Global Page Cnt	MNR_PRO$W_GPGCNT	Current global page count (word,L)
Process Page Cnt	MNR_PRO$W_PPGCNT	Current process page count (word,L)
Status Flags	MNR_PRO$L_STS	Software process status flags (PCB$V_RES bit clear implies swapped out) (longword,I)
Direct I/Os	MNR_PRO$L_DIOCNT	Direct I/O count (0 if swapped out) (longword,C)
Page Faults	MNR_PRO$L_PAGEFLTS	Page fault count (0 if swapped out) (longword,C)
CPU Time	MNR_PRO$L_CPUTIM	Accumulated CPU time, in 10ms ticks (0 if swapped out) (longword,C)
Buffered I/Os	MNR_PRO$L_BIOCNT	Buffered I/O count (0 if swapped out) (longword,C)
Extended Proc ID	MNR_PRO$L_EPID	Extended process identification (longword,I)
Event Flg Wt Mask	MNR_PRO$L_EFWM	Event flag wait mask (used for MWAITs) (longword, I)

A.4.3 STATES Class Record

The STATES class record contains data describing the number of processes in each of the scheduler states. The STATES class record has a record type of 1 and a size of 69 bytes.

Figure MON–8 illustrates the format of the STATES class record.
Table MON–10 describes the fields in the data block for the STATES class record.

Figure MON–8 STATES Class Record Format

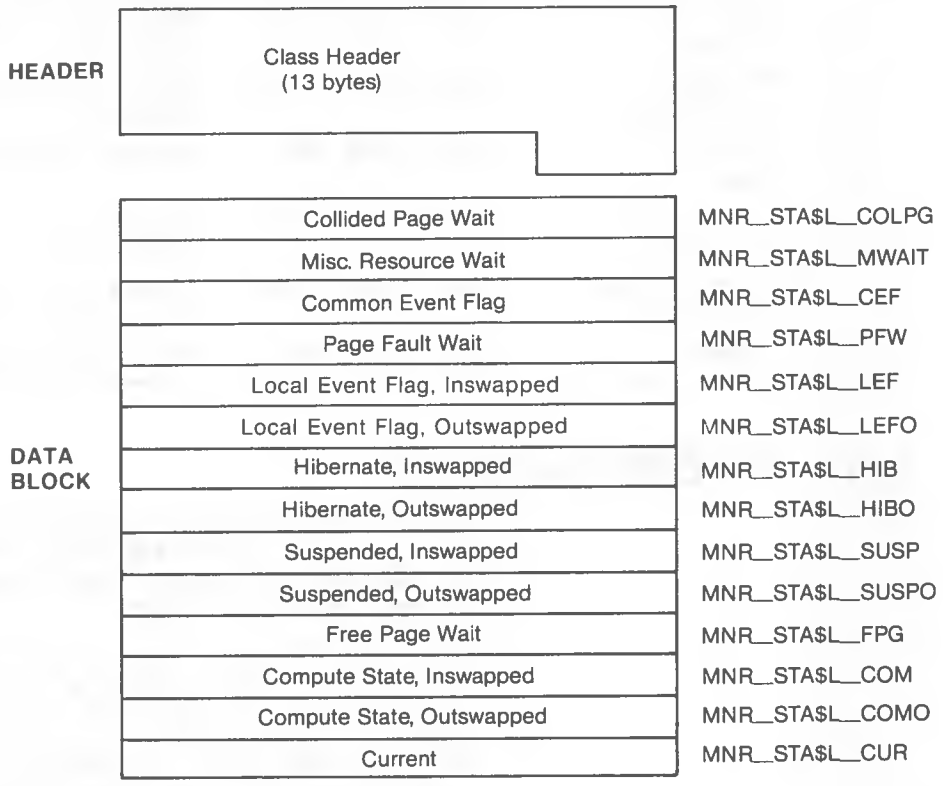

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Table MON–10 Descriptions of STATES Class Record Fields

Field	Symbolic Offset	Contents
Collided Page Wait	MNR_STA$L_COLPG	Number of processes in collided page wait (longword,L)
Misc Resource Wait	MNR_STA$L_MWAIT	Number of processes in miscellaneous resource wait (longword,L)
Common Event Flag Wait	MNR_STA$L_CEF	Number of processes in common event flag wait (longword,L)
Page Fault Wait	MNR_STA$L_PFW	Number of processes in page fault wait (longword,L)
Loc Event Flag, Inswapped	MNR_STA$L_LEF	Number of processes in local event flag wait, inswapped (longword,L)
Loc Event Flag, Outswapped	MNR_STA$L_LEFO	Number of processes in local event flag wait, outswapped (longword,L)
Hibernate Inswapped	MNR_STA$L_HIB	Number of processes in hibernate wait, inswapped (longword,L)
Hibernate Outswapped	MNR_STA$L_HIBO	Number of processes in hibernate wait, outswapped (longword,L)

Table MON–10 (Cont.) Descriptions of STATES Class Record Fields

Field	Symbolic Offset	Contents
Suspended Inswapped	MNR_STA$L_SUSP	Number of processes in suspended wait, inswapped (longword,L)
Suspended Outswapped	MNR_STA$L_SUSPO	Number of processes in suspended wait, outswapped (longword,L)
Free Page Wait	MNR_STA$L_FPG	Number of processes in free wait (longword,L)
Compute State Inswapped	MNR_STA$L_COM	Number of processes in compute state, inswapped (longword,L)
Compute State Outswapped	MNR_STA$L_COMO	Number of processes in compute state, outswapped (longword,L)
Current	MNR_STA$L_CUR	Number of current processes (longword,L)

A.4.4 MODES Class Record

The MODES class record contains data describing time spent in each of the processor modes. The MODES class record has a record type of 2. Its size is 41 bytes when monitoring a single processor, and 69 bytes when monitoring two processors (VAX–11/782).

Figure MON–9 illustrates the format of the MODES class record. Table MON–11 describes the fields in the data block for the MODES class record. The first seven fields refer to the primary processor. The last seven fields refer to the attached processor; they are included in the MODES record only if the MNR_SYI$B_MPCPUS field of the System Information Record contains a value of 2, indicating that two processors are being monitored.

Figure MON–9 MODES Class Record Format

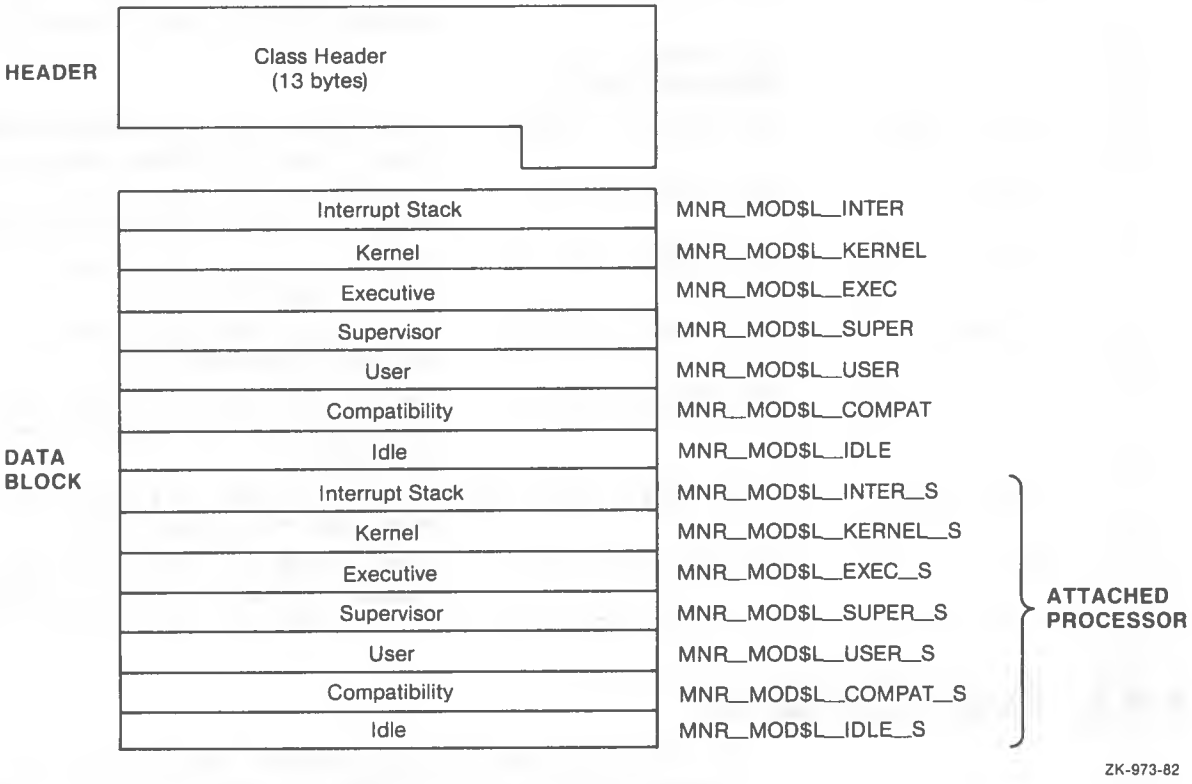

Table MON–11 Descriptions of MODES Class Record Fields

Field	Symbolic Offset	Contents
	Fields Referred to Primary Processor	
Interrupt Stack	MNR_MOD$L_INTER	Count of clock ticks (10-millisecond units) spent on interrupt stack since system was booted (longword,C)
Kernel	MNR_MOD$L_KERNEL	Count of clock ticks since system boot spent in kernel mode, excluding interrupt stack time (longword,C)
Executive	MNR_MOD$L_EXEC	Count of clock ticks since system boot spent in executive mode (longword,C)
Supervisor	MNR_MOD$L_SUPER	Count of clock ticks since system boot spent in supervisor mode (longword,C)
User	MNR_MOD$L_USER	Count of clock ticks since system boot spent in user mode, excluding compatibility-mode time (longword,C)
Compatibility	MNR_MOD$L_COMPAT	Count of clock ticks since system boot spent in compatibility mode (longword,C)

Table MON–11 (Cont.) Descriptions of MODES Class Record Fields

Field	Symbolic Offset	Contents
Idle	MNR_MOD$L_IDLE	Count of clock ticks since system boot spent executing the NULL process (longword,C)
	Fields Referred to Attached Processor	
Interrupt Stack	MNR_MOD$L_INTER_S	Count of clock ticks (10-millisecond units) spend on interrupt stack since system was booted (longword,C)
Kernel	MNR_MOD$L_KERNEL_S	Count of clock ticks since system boot spent in kernel mode, excluding interrupt stack time (longword,C)
Executive	MNR_MOD$L_EXEC_S	Count of clock ticks since system boot spent in executive mode (longword,C)
Supervisor	MNR_MOD$L_SUPER_S	Count of clock ticks since system boot spent in supervisor mode (longword,C)
User	MNR_MOD$L_USER_S	Count of clock ticks since system boot spent in user mode, excluding compatibility-mode time (longword,C)
Compatibility	MNR_MOD$L_COMPAT_S	Count of clock ticks since system boot spent in compatibility mode (longword,C)
Idle	MNR_MOD$L_IDLE_S	Count of clock ticks since system boot spent executing the NULL process (longword,C)

A.4.5 PAGE Class Record

The PAGE class record contains data describing the operation of the page management subsystem. The PAGE class record has a record type of 3 and a size of 65 bytes.

Figure MON–10 illustrates the format of the PAGE class record. Table MON–12 describes the fields in the data block for the PAGE class record.

Figure MON–10 PAGE Class Record Format

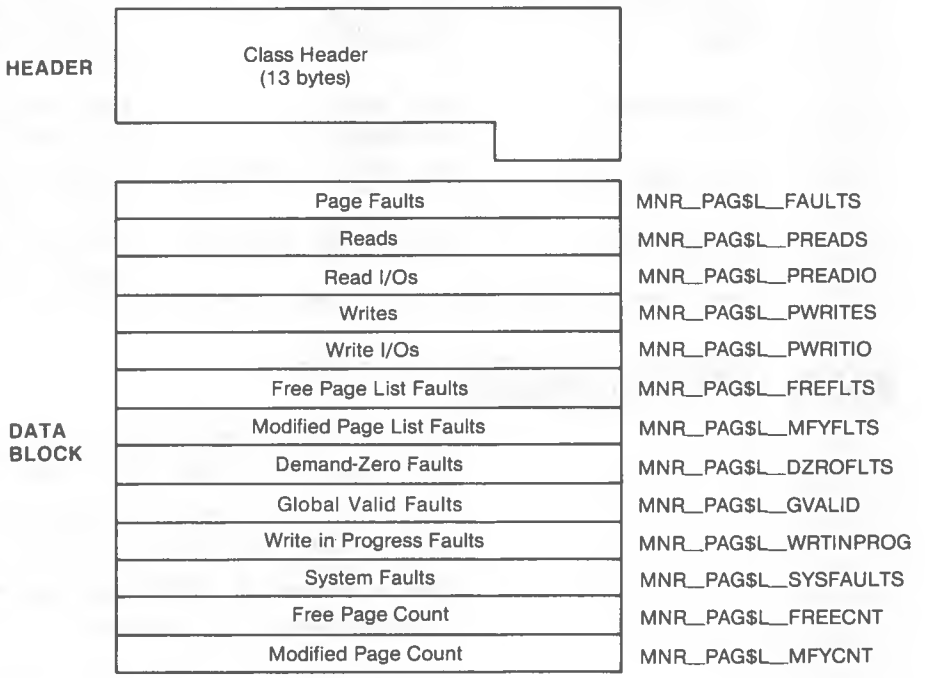

Table MON–12 Descriptions of PAGE Class Record Fields

Field	Symbolic Offset	Contents
Page Faults	MNR_PAG$L_FAULTS	Count of page faults for all working set (longword,C)
Reads	MNR_PAG$L_PREADS	Count of pages read from disk as a result of page faults (longword,C)
Read I/Os	MNR_PAG$L_PREADIO	Count of read I/Os as a result of operations from disk page faults (longword,C)
Writes	MNR_PAG$L_PWRITES	Count of pages written to the page file (longword,C)
Write I/Os	MNR_PAG$L_PWRITIO	Count of write I/O operations to the page file (longword,C)
Free Page List Faults	MNR_PAG$L_FREFLTS	Count of pages read from the free list as a result of page faults (longword,C)
Modified Page List Faults	MNR_PAG$L_MFYFLTS	Count of pages read from the modified list as a result of page faults (longword,C)
Demand-zero Faults	MNR_PAG$L_DZROFLTS	Count of zero-filled pages allocated as a result of faults (longword,C)
Global Valid Faults	MNR_PAG$L_GVALID	Count of page faults for which the reference page was found to be valid in the system global page tables (longword,C)

Table MON–12 (Cont.) Descriptions of PAGE Class Record Fields

Field	Symbolic Offset	Contents
Write in Progress Faults	MNR_PAG$L_ WRTINPROG	Count of pages read that were in the process of being written back to disk when faulted (longword,C)
System Faults	MNR_PAG$L_ SYSFAULTS	Count of page faults for which the referenced page is in system space (longword,C)
Free Page Count	MNR_PAG$L_FREECNT	Number of pages currently on free page list (longword,L)
Modified Page Count	MNR_PAG$L_MFYCNT	Number of pages currently on modified page list (longword,L)

A.4.6 I/O Class Record

The I/O class record contains data describing the operation of the I/O subsystem. The I/O class record has a record type of 4 and a size of 69 bytes.

Figure MON–11 illustrates the format of the I/O class record. Table MON–13 describes the fields in the data block for the I/O class record.

Figure MON–11 I/O Class Record Format

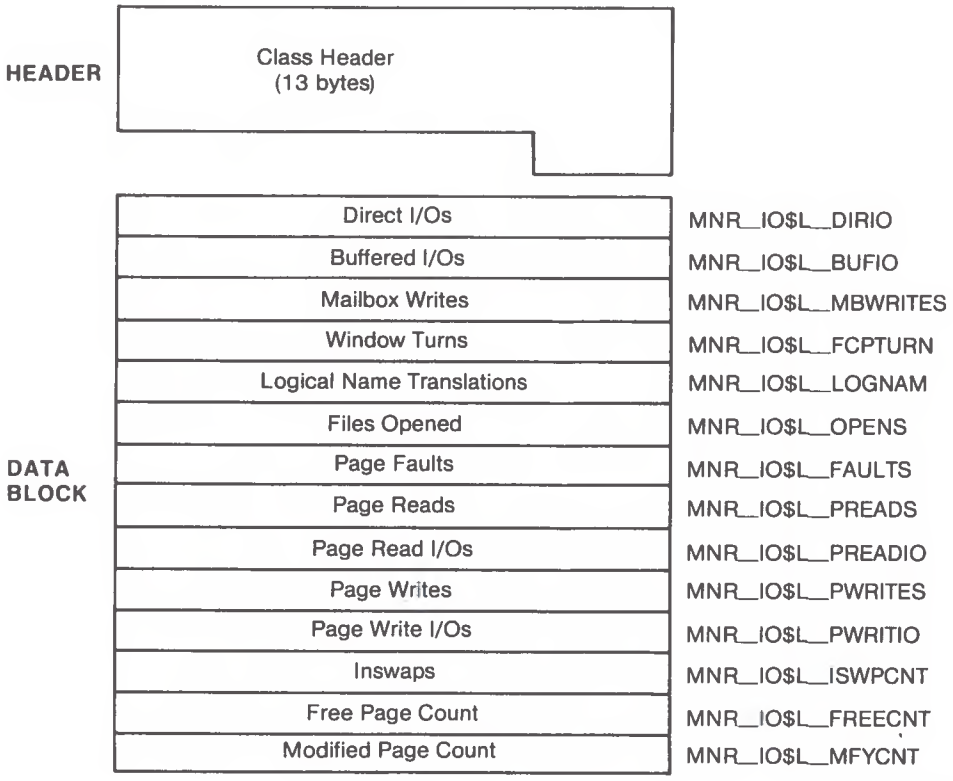

Table MON–13 Descriptions of I/O Class Record Fields

Field	Symbolic Offset	Contents
Direct I/Os	MNR_IO$L_DIRIO	Count of direct I/O operations (longword,C)
Buffered I/Os	MNR_IO$L_BUFIO	Count of buffered I/O operations (longword,C)
Mailbox Writes	MNR_IO$L_MBWRITES	Count of write-to-mailbox requests (longword,C)
Window Turns	MNR_IO$L_FCPTURN	Count of file-map window misses (longword,C)
Logical Name Translations	MNR_IO$L_LOGNAM	Count of logical name translations (longword,C)
Files Opened	MNR_IO$L_OPENS	Count of files opened (longword,C)
Page Faults	MNR_IO$L_FAULTS	Count of page faults for all working sets (longword,C)
Page Reads	MNR_IO$L_PREADS	Count of pages read from disk as a result of page faults (longword,C)
Page Read I/Os	MNR_IO$L_PREADIO	Count of read I/O operations from disk as a result of page faults (longword,C)
Page Writes	MNR_IO$L_PWRITES	Count of pages written to the page file (longword,C)
Page Write I/Os	MNR_IO$L_PWRITIO	Count of write I/O operations to the page file (longword,C)
Inswaps	MNR_IO$L_ISWPCNT	Count of working sets read into memory from the swap file (longword,C)
Free Page Count	MNR_IO$L_FREECNT	Number of pages currently on free page list (longword,L)
Modified Page Count	MNR_IO$L_MFYCNT	Number of pages currently on modified page list (longword,L)

A.4.7 FCP Class Record

The FCP class record contains data describing the operation of the file system ACPs. The FCP class record has a record type of 5 and a size of 61 bytes.

Figure MON–12 illustrates the format of the FCP class record.
Table MON–14 describes the fields in the data block for the FCP class record.

Figure MON–12 FCP Class Record Format

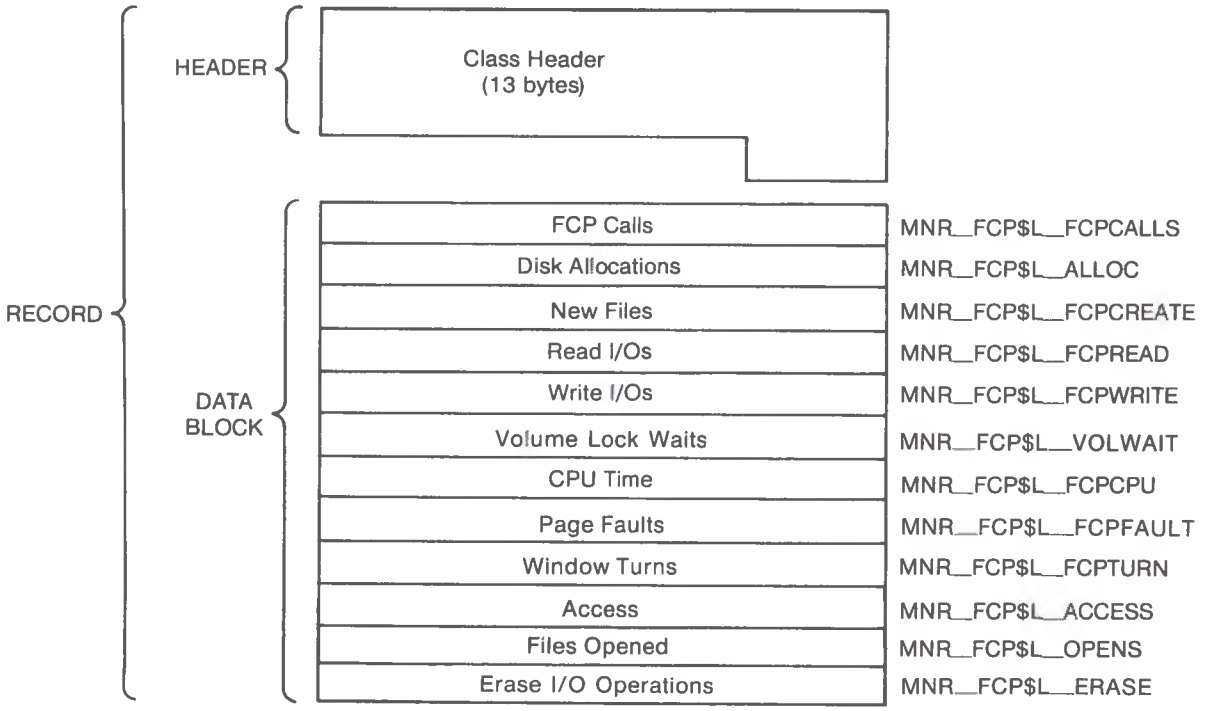

Table MON–14 Descriptions of FCP Class Record Fields

Field	Symbolic Offset	Contents
FCP Calls	MNR_FCP$L_FCPCALLS	Count of QIO requests received by the file system (longword,C)
Disk Allocations	MNR_FCP$L_ALLOC	Count of QIO requests that caused allocation of disk space (longword,C)
New Files	MNR_FCP$L_ FCPCREATE	Count of new files created (longword,C)
Read I/Os	MNR_FCP$L_FCPREAD	Count of read I/O operations from the disk by the file system (longword,C)
Write I/Os	MNR_FCP$L_FCPWRITE	Count of write I/O operations to disk by the file system (longword,C)
Volume Lock Waits	MNR_FCP$L_VOLWAIT	Number of times a wait state was entered by the XQP due to volume lock contention (longword,C)
CPU Time	MNR_FCP$L_FCPCPU	Count of clock ticks (10-millisecond units) of CPU time used by the file system (longword,C)
FCP Page Faults	MNR_FCP$L_FCPFAULT	Count of page faults for the file system (longword,C)
Window Turns	MNR_FCP$L_FCPTURN	Count of file-map window misses (longword,C)

Table MON–14 (Cont.) Descriptions of FCP Class Record Fields

Field	Symbolic Offset	Contents
Access	MNR_FCP$L_ACCESS	Count of filename lookup operations in file directories (longword,C)
Files Opened	MNR_FCP$L_OPENS	Count of files opened (longword,C)
Erase I/O Operations	MNR_FCP$L_ERASE	Count of erase I/O operations issued (longword,C)

A.4.8 POOL Class Record

The POOL class record contains data describing space allocation in the nonpaged dynamic pool. The POOL class record has a record type of 6 and a size of 61 bytes.

Figure MON–13 illustrates the format of the POOL class record. Table MON–15 describes the fields in the data block for the POOL class record.

Figure MON–13 POOL Class Record Format

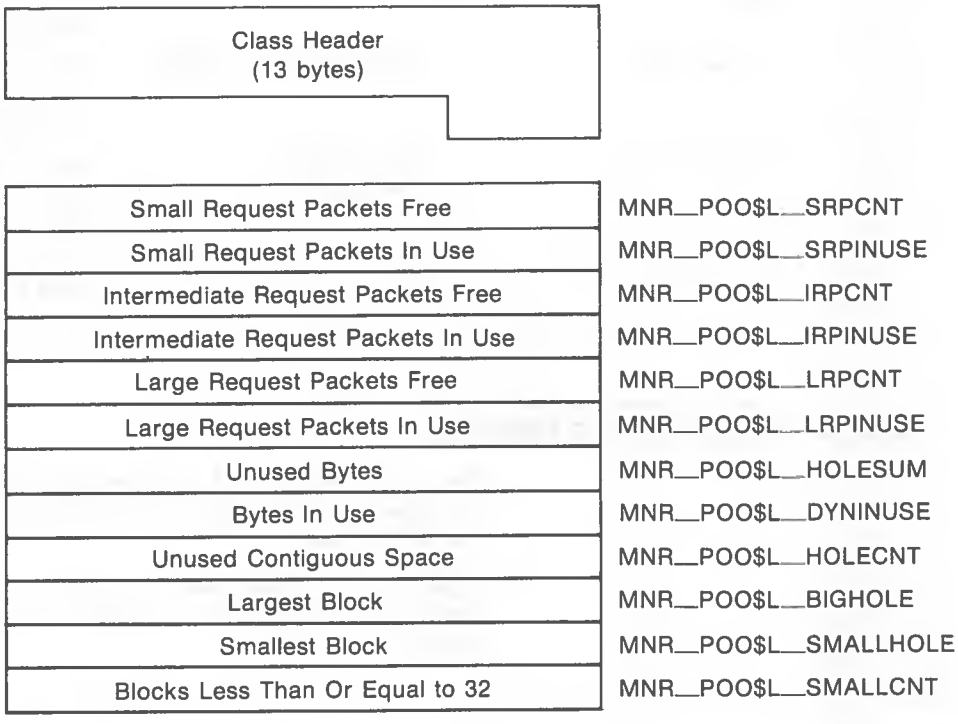

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Table MON–15 Descriptions of POOL Class Record Fields

Field	Symbolic Offset	Contents
Small Request Packets Available	MNR_POO$L_SRPCNT	Number of preallocated small request packets left in lookaside list (longword,L)
Small Request Packets In Use	MNR_POO$L_SRPINUSE	Number of preallocated small request packets in use (longword,L)
Intermediate Request Packets Available	MNR_POO$L_IRPCNT	Number of preallocated intermediate request packets left in lookaside list (longword,L)
Intermediate Request Packets In Use	MNR_POO$L_IRPINUSE	Number of preallocated intermediate request packets in use (longword,L)
Large Request Packets Available	MNR_POO$L_LRPCNT	Number of preallocated large request packets left in lookaside list (longword,L)
Large Request Packets In Use	MNR_POO$L_LRPINUSE	Number of preallocated large request packets in use (longword,L)
Unused Bytes In Dynamic Nonpaged Pool	MNR_POO$L_HOLESUM	Total unused bytes in the dynamically allocated portion of nonpaged pool (longword,L)
Bytes Of Dynamic Nonpaged Pool In Use	MNR_POO$L_DYNINUSE	Number of bytes in the dynamically allocated portion of nonpaged pool (longword,L)
Unused Contiguous Space	MNR_POO$L_HOLECNT	Number of unused blocks of contiguous space in the dynamically allocated portion of nonpaged pool (longword,L)
Largest Block	MNR_POO$L_BIGHOLE	Size in bytes of the largest block of unused space in the dynamically allocated portion of nonpaged pool (longword,L)
Smallest Block	MNR_POO$L_ SMALLHOLE	Size in bytes of the smallest block of unused space in the dynamically allocated portion of nonpaged pool (longword,L)
Blocks Less Than Or Equal to 32	MNR_POO$L_SMALLCNT	Number of blocks less than or equal to 32 bytes in size in the dynamically allocated portion of nonpaged pool (longword,L)

A.4.9 LOCK Class Record

The LOCK class record contains data describing the operation of the lock management subsystem. The LOCK class record has a record type of 7 and a size of 53 bytes.

Figure MON–14 illustrates the format of the LOCK class record.
Table MON–16 describes the fields in the data block for the LOCK class record.

Figure MON–14 LOCK Class Record Format

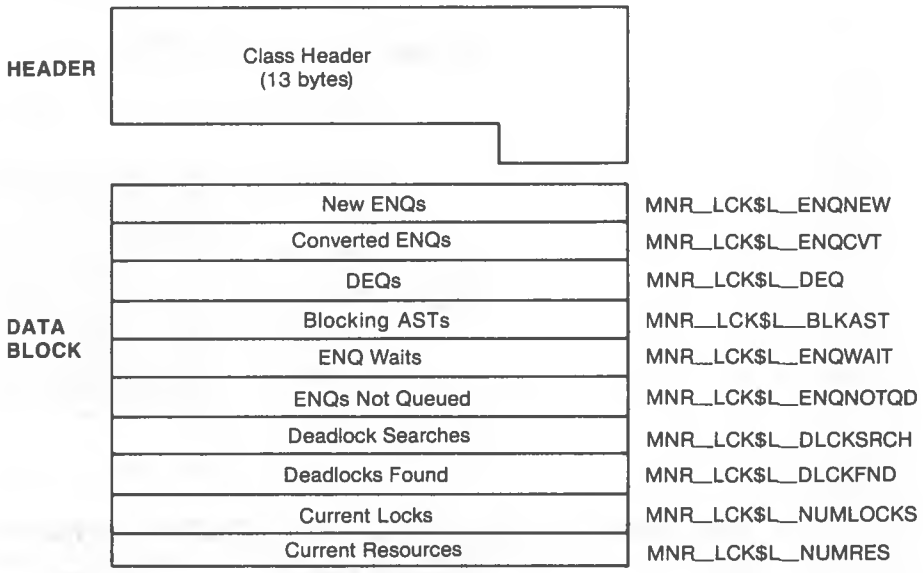

Table MON–16 Descriptions of LOCK Record Fields

Field	Symbolic Offset	Contents
New ENQs	MNR_LCK$L_ENQNEW	Count of new ENQ (lock) requests (longword,C)
Converted ENQs	MNR_LCK$L_ENQCVT	Count of converted ENQ (lock) requests (longword,C)
DEQs	MNR_LCK$L_DEQ	Count of DEQ (unlock) requests (longword,C)
Blocking ASTs	MNR_LCK$L_BLKAST	Count of blocking ASTs queued (longword,C)
ENQ Waits	MNR_LCK$L_ENQWAIT	Count of times a lock could not be granted immediately and waited (longword,C)
ENQs Not Queued	MNR_LCK$L_ENQNOTQD	Count of times a lock could not be granted immediately and got an error status instead of waiting (longword,C)
Deadlock Searches	MNR_LCK$L_DLCKSRCH	Count of times that a deadlock search was performed (longword,C)
Deadlocks Found	MNR_LCK$L_DLCKFND	Count of times that a deadlock was found (longword,C)
Current Locks	MNR_LCK$L_NUMLOCKS	Number of locks currently in the system (longword,L)
Current Resources	MNR_LCK$L_NUMRES	Number of resources currently in the system (longword,L)

A.4.10 DECNET Class Record

The DECNET class record contains data describing the operation of the DECnet–VAX subsystem. The DECNET class record has a record type of 8 and a size of 37 bytes.

Figure MON–15 illustrates the format of the DECNET class record. Table MON–17 describes the fields in the data block for the DECNET class record.

Figure MON–15 DECNET Class Record Format

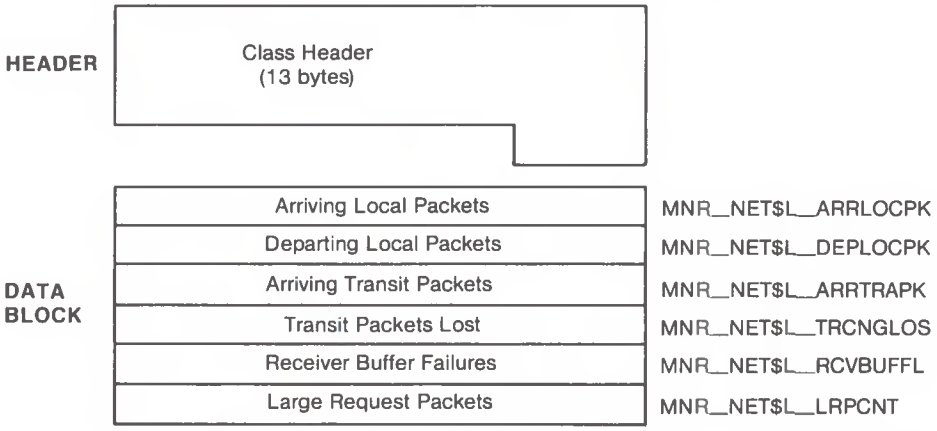

Table MON–17 Descriptions of DECNET Class Record Fields

Field	Symbolic Offset	Contents
Arriving Local Packets	MNR_NET$L_ARRLOCPK	Count of arriving local packets (longword,C)
Departing Local Packets	MNR_NET$L_DEPLOCPK	Count of departing local packets (longword,C)
Arriving Transit Packets	MNR_NET$L_ARRTRAPK	Count of arriving transit packets (longword,C)
Transit Packets Lost	MNR_NET$L_TRCNGLOS	Count of packets lost because of transit congestion (longword,C)
Receiver Buffer Failures	MNR_NET$L_RCVBUFFL	Count of receiver buffer failures (longword,C)
Large Request Packets	MNR_NET$L_LRPCNT	Number of preallocated large request packets left in nonpaged pool (longword,L)

A.4.11 FILE_SYSTEM_CACHE Class Record

The FILE_SYSTEM_CACHE class record contains data describing the operation of the caches for the file system ACPs and XQPs . The FILE_SYSTEM_CACHE class record has a record type of 11 and a size of 69 bytes.

Figure MON–16 illustrates the format of the FILE_SYSTEM_CACHE class record. Table MON–18 describes the fields in the data block for the FILE_SYSTEM_CACHE class record.

Figure MON–16 FILE_SYSTEM_CACHE Class Record Format

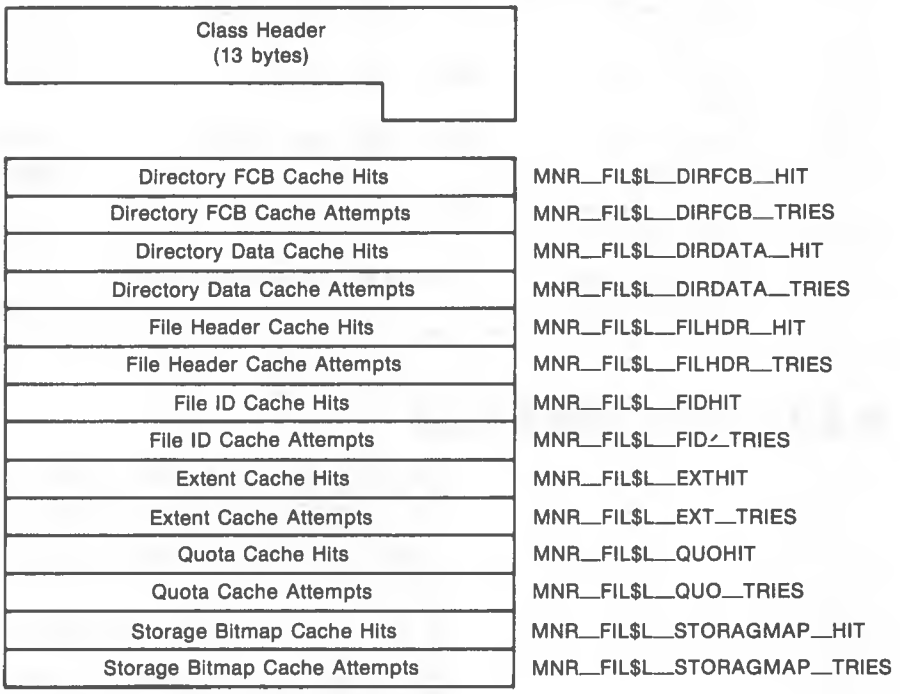

Table MON–18 Descriptions of FILE_SYSTEM_CACHE Class Record Fields

Field	Symbolic Offset	Contents
Directory FCB Cache Hits	MNR_FIL$L_DIRFCB_HIT	Count of hits on Directory FCB cache (longword,C)
Directory FCB Cache Attempts	MNR_FIL$L_DIRFCB_TRIES	Count of attempts on Directory FCB cache (longword,C)
Directory Data Cache Hits	MNR_FIL$L_DIRDATA_HIT	Count of hits on Directory Data cache (longword,C)
Directory Data Cache Attempts	MNR_FIL$L_DIRDATA_TRIES	Count of attempts on Directory Data cache (longword,C)
File Header Cache Hits	MNR_FIL$L_FILHDR_HIT	Count of hits on File Header cache (longword,C)
File Header Cache Attempts	MNR_FIL$L_FILHDR_TRIES	Count of attempts on File Header cache (longword,C)
File ID Cache Hits	MNR_FIL$L_FIDHIT	Count of hits on File ID cache (longword,C)
File ID Cache Attempts	MNR_FIL$L_FID_TRIES	Count of attemps on File ID cache (longword,C)
Extent Cache Hits	MNR_FIL$L_EXTHIT	Count of hits on Extent cache (longword,C)

Table MON–18 (Cont.) Descriptions of FILE_SYSTEM_CACHE Class Record Fields

Field	Symbolic Offset	Contents
Extent Cache Attempts	MNR_FIL$L_EXT_TRIES	Count of attempts on Extent cache (longword,C)
Quota Cache Hits	MNR_FIL$L_QUOHIT	Count of hits on Quota Cache (longword,C)
Quota Cache Attempts	MNR_FIL$L_QUO_TRIES	Count of attempts on Quota cache (longword,C)
Storage Bitmap Cache Hits	MNR_FIL$L_STORAGMAP_HIT	Count of hits on Storage Bitmap cache (longword,C)
Storage Bitmap Cache Attempts	MNR_FIL$L_STORAGMAP_TRIES	Count of attempts on Storage Bitmap cache (longword,C)

A.4.12 DISK Class Record

The DISK class record contains data describing all disk devices in the system. The DISK class record has a record type of 12; its size depends on the number of disks being monitored. The size, in bytes, is calculated by adding the size of the class header, the class prefix, and the data blocks contained in the record:

```
13 + 8 + (35 * the value of MNR_CMP$L_ELTCT)
```

Figure MON–17 illustrates the format of the DISK class record. Table MON–19 describes the fields in the data block for the DISK class record.

Figure MON–17 DISK Class Record Format

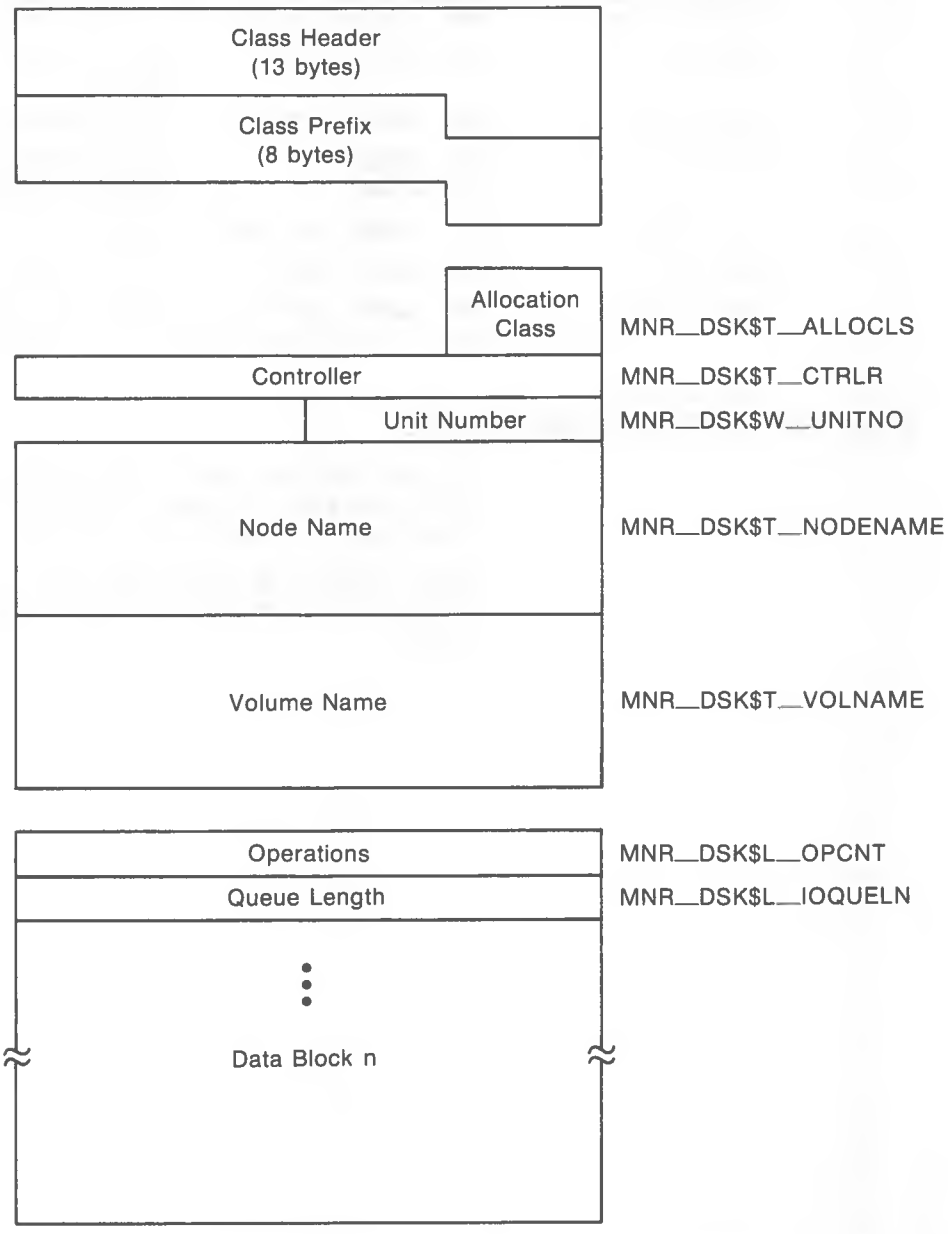

Table MON–19 Descriptions of DISK Class Record Fields

Field	Symbolic Offset	Contents
Allocation Class	MNR_DSK$B_ALLOCLS	Allocation class number (byte,I)
Controller	MNR_DSK$T_CTRLR	Name of device controller (counted ASCII string) (4 bytes,I)
Unit Number	MNR_DSK$W_UNITNO	Unit number (word,I)
Node Name	MNR_DSK$T_ NODENAME	Name of cluster node where device resides (counted ASCII string) (8 bytes,I)
Volume Name	MNR_DSK$T_VOLNAME	Volume name of disk (ASCII) (12 bytes,I)
Operations	MNR_DSK$L_OPCNT	Count of I/O operations (longword,C)
Queue Length	MNR_DSK$L_IOQUELN	Sum of I/O request queue samples (longword,C)

A.4.13 DLOCK Class Record

The DLOCK class record contains data describing the operation of the Distributed Lock Management Facility. The DLOCK class record has a record type of 14 and a size of 73 bytes.

Figure MON–18 illustrates the format of the DLOCK class record. Table MON–20 describes the fields in the data block for the DLOCK class record.

Figure MON–18 DLOCK Class Record Format

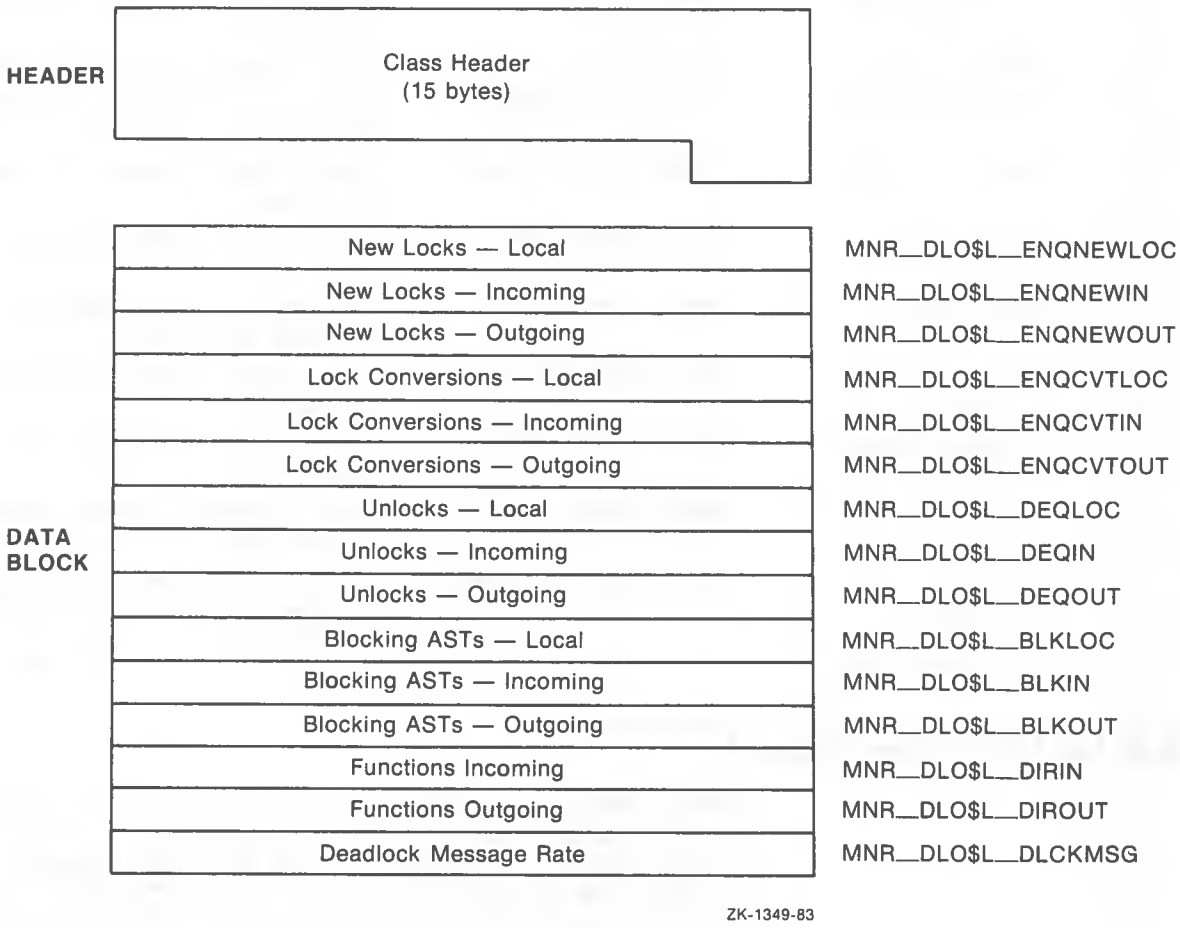

Table MON–20 Descriptions of DLOCK Class Record Fields

Field	Symbolic Offset	Contents
New Locks —Local	MNR_DLO$L_ ENQNEWLOC	Count of new lock requests which originate and are performed on this system (local) (longword,C)
New Locks —Incoming	MNR_DLO$L_ENQNEWIN	Count of new lock requests originating on another system and performed on this system (incoming) (longword,C)
New Locks —Outgoing	MNR_DLO$L_ ENQNEWOUT	Count of new lock requests originating on this system and performed on another system (outgoing) (longword,C)
Lock Conversions —Local	MNR_DLO$L_ENQCVTLOC	Count of lock conversion requests (local) (longword,C)
Lock Conversions —Incoming	MNR_DLO$L_ENQCVTIN	Count of lock conversion requests (incoming) (longword,C)

Table MON–20 (Cont.) Descriptions of DLOCK Class Record Fields

Field	Symbolic Offset	Contents
Lock Conversions —Outgoing	MNR_DLO$L_ ENQCVTOUT	Count of lock conversion requests (outgoing) (longword,C)
Unlocks—Local	MNR_DLO$L_DEQLOC	Count of unlock requests (local) (longword,C)
Unlocks—Incoming	MNR_DLO$L_DEQIN	Count of unlock requests (incoming) (longword,C)
Unlocks—Outgoing	MNR_DLO$L_DEQOUT	Count of unlock requests (outgoing) (longword,C)
Blocking ASTs —Local	MNR_DLO$L_BLKLOC	Count of lock manager blocking ASTs (local) (longword,C)
Blocking ASTs —Incoming	MNR_DLO$L_BLKIN	Count of lock manager blocking ASTs (incoming) (longword,C)
Blocking ASTs —Outgoing	MNR_DLO$L_BLKOUT	Count of lock manager blocking ASTs (outgoing) (longword,C)
Directory Functions —Incoming	MNR_DLO$L_DIRIN	Count of directory functions (incoming) (longword,C)
Directory Functions —Outgoing	MNR_DLO$L_DIROUT	Count of directory functions (outgoing) (longword,C)
Deadlock Message Rate	MNR_DLO$L_DLCKMSG	Count of incoming and outgoing lock manager messages required for deadlock detection (longword,C)

A.4.14 SCS Class Record

The SCS class record contains data describing SCS (System Communication Services) activity for all SCS connections in the system, on a per-node basis. The SCS class record has a record type of 15; its size depends on the number of nodes being monitored. The size, in bytes, is calculated by adding the size of the class header, the class prefix, and the data blocks contained in the record:

```
13 + 8 + (56 * the value of MNR_CMP$L_ELTCT)
```

Figure MON–19 illustrates the format of the SCS class record.
Table MON–21 describes the fields in the data block for the SCS class record.

Figure MON–19 SCS Class Record Format

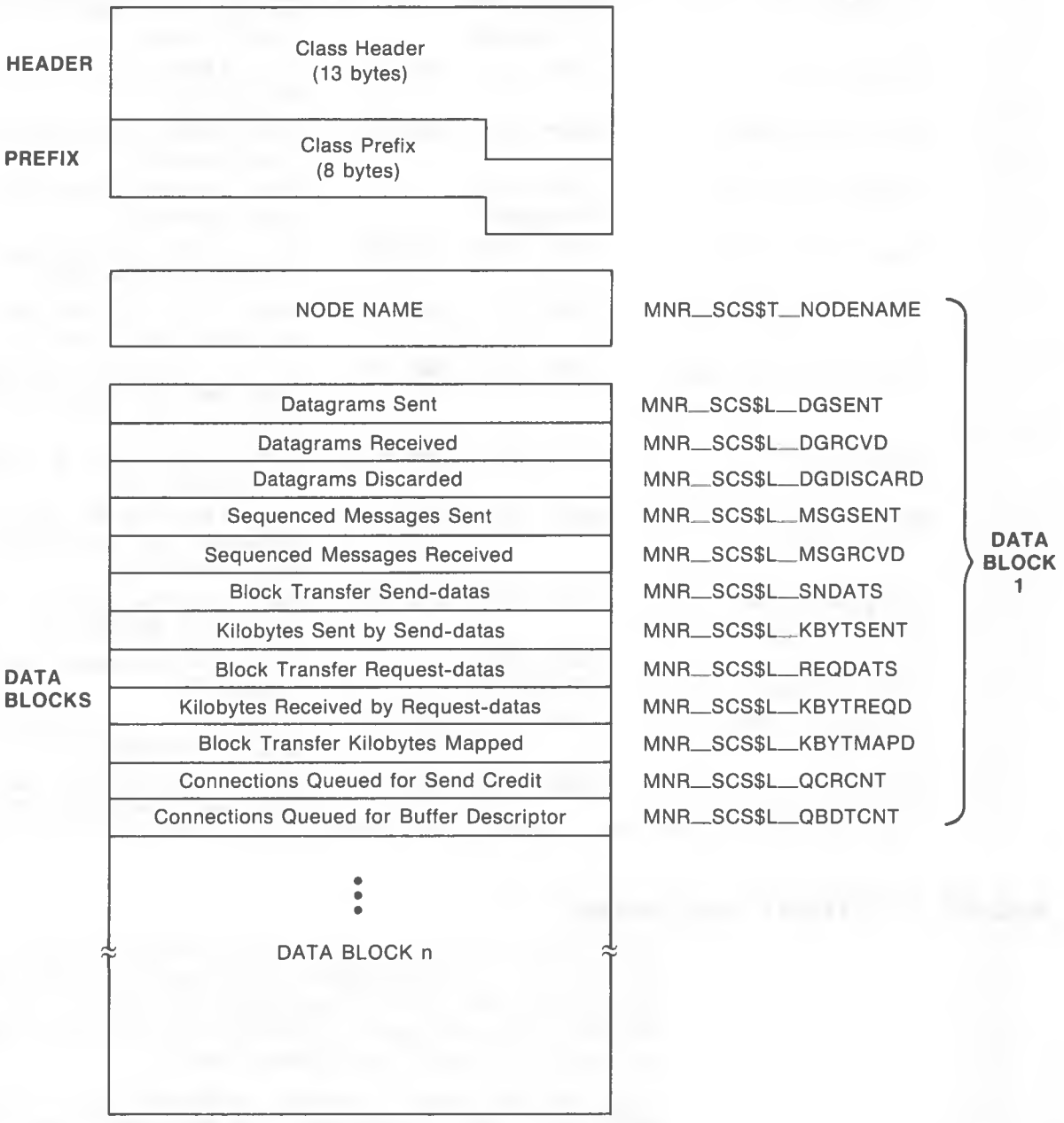

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Table MON–21 Descriptions of SCS Class Record Fields

Field	Symbolic Offset	Contents
Node Name	MNR_SCS$T_ NODENAME	Name of remote cluster node (counted ASCII string) (8 bytes,I)
Datagrams Sent	MNR_SCS$L_DGSENT	Count of datagrams sent to the remote node (longword,C)
Datagrams Received	MNR_SCS$L_DGRCVD	Count of datagrams received from the remote node (longword,C)
Datagrams Discarded	MNR_SCS$L_ DGDISCARD	Count of datagrams discarded by the CI port driver (longword,C)
Sequenced Msgs Sent	MNR_SCS$L_MSGSENT	Count of sequenced messages sent to the remode node (longword,C)
Seqenced Msgs Received	MNR_SCS$L_MSGRCVD	Count of sequenced messages received from the remote node (longword,C)
Block Transfer Send-datas	MNR_SCS$L_SNDATS	Count of block transfer send-datas initiated on the local node, targeted for the remote node (longword,C)
Kilobytes Sent by Send-datas	MNR_SCS$L_KBYTSENT	Count of kilobytes sent as a result of send-datas (longword,C)
Block Transfer Request-datas	MNR_SCS$L_REQDATS	Count of block transfer request-datas initiated on the local node, targeted for the remote node (longword,C)
Kilobytes Received by Request-datas	MNR_SCS$L_KBYTREQD	Count of kilobytes received as a result of request-datas (longword,C)
Block Transfer Kilobytes Mapped	MNR_SCS$L_ KBYTMAPD	Count of kilobytes mapped for block transfers (longword,C)
Connections Queued For Send Credit	MNR_SCS$L_QCRCNT	Count of times connections are queued for send credits (longword,C)
Connections Queued For Buffer Descriptor	MNR_SCS$L_QBDTCNT	Count of times connections are queued for buffer descriptors (longword,C)

A.4.15 SYSTEM Class Record

The SYSTEM class record contains data describing the overall operation of the three major system components (CPU, memory, I/O). The SYSTEM class record has a record type of 17 and a size of 49 bytes. Please note that when the SYSTEM class is recorded, the PROCESSES, STATES, and MODES classes are also recorded, even if not explicitly requested.

Figure MON–20 illustrates the format of the SYSTEM class record. Table MON–22 describes the fields in the data block for the SYSTEM class record.

Figure MON–20 SYSTEM Class Record Format

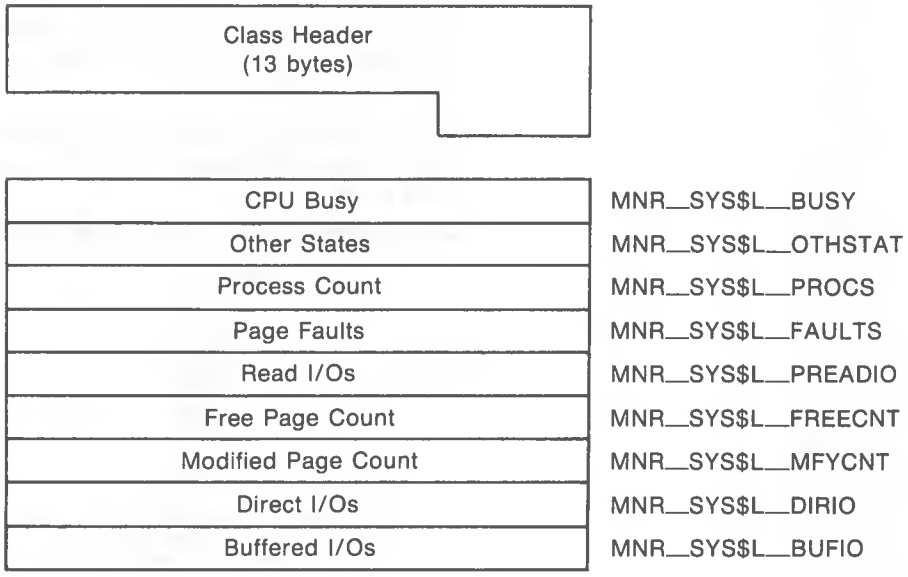

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Table MON–22 Descriptions of SYSTEM Class Record Fields

Field	Symbolic Offset	Contents
CPU Busy	MNR_SYS$L_BUSY	Count of clock ticks (10-millisecond units) spent in all CPU modes since system was booted (longword,C)
Other States	MNR_SYS$L_ OTHSTAT	Number of processes in states other than LEF, LEFO, HIB, HIBO, COM, COMO, PFW, and MWAIT (longword,L)
Process Count	MNR_SYS$L_PROCS	Number of processes in system (longword,L)
Page Faults	MNR_SYS$L_FAULTS	Count of page faults for all working sets (longword,C)
Read I/Os	MNR_SYS$L_PREADIO	Count of read I/Os resulting from disk page faults (longword,C)
Free Page Count	MNR_SYS$L_FREECNT	Number of pages currently on free page list (longword,L)
Modified Page Count	MNR_SYS$L_MFYCNT	Number of pages currently on modified page list (longword,L)
Direct I/Os	MNR_SYS$L_DIRIO	Count of direct I/O operations (longword,C)
Buffered I/Os	MNR_SYS$L_BUFIO	Count of buffered I/O operations (longword,C)

A.4.16 CLUSTER Class Record

The CLUSTER class record contains data describing clusterwide CPU, memory, and locking activity. The CLUSTER class record has a record type of 19 and a size of 65 bytes. Please note that when the CLUSTER class is recorded, the DISK and MODES classes are also recorded, even if not explicitly requested.

Figure MON–21 illustrates the format of the CLUSTER class record. Table MON–23 describes the fields in the data block for the CLUSTER class record.

Figure MON–21 CLUSTER Class Record Format

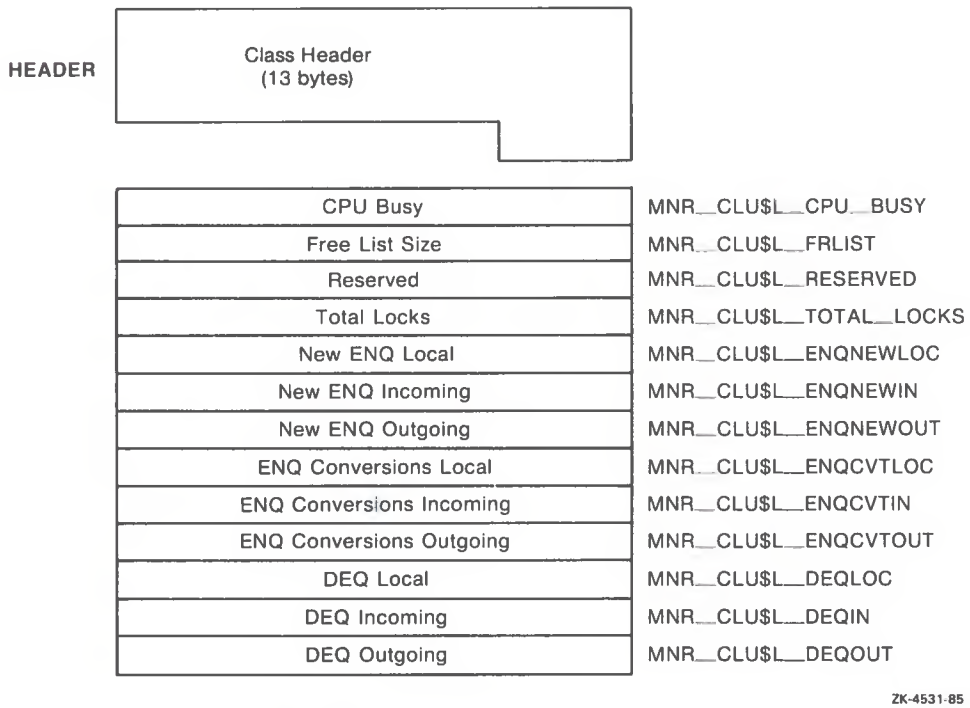

Table MON–23 Descriptions of CLUSTER Class Record Fields

Field	Symbolic Offset	Contents
CPU Busy	MNR_CLU$L_CPU_BUSY	Count of clock ticks (10-millisecond units) spent in all CPU modes since system was booted (longword,C)
Free List Size	MNR_CLU$L_FRLIST	Number of pages currently on the free list (longword,L)
Reserved	MNR_CLU$L_RESERVED	Reserved to DIGITAL
Total Locks	MNR_CLU$L_TOTAL_LOCKS	Total of all incoming, outgoing, and local ENQs, DEQs, and conversions (longword,C)
New Enq Local	MNR_CLU$L_ENQNEWLOC	Count of new lock requests which originate and are performed on the system (local) (longword,C)
New Enq Incoming	MNR_CLU$L_ENQNEWIN	Count of new lock requests which originate on other systems and are performed on this system (incoming) (longword,C)
New Enq Outgoing	MNR_CLU$L_ENQNEWOUT	Count of new lock requests which originate on this system and are performed on other systems (outgoing) (longword,C)
Enq Conversions Local	MNR_CLU$L_ENQCVTLOC	Count of lock conversion requests (local) (longword,C)
Enq Conversions Incoming	MNR_CLU$L_ENQCVTIN	Count of lock conversion requests (incoming) (longword,C)
Enq Conversions Outgoing	MNR_CLU$L_ENQCVTOUT	Count of lock conversion requests (outgoing) (longword,C)
Deq Local	MNR_CLU$L_DEQLOC	Count of unlock requests (local) (longword,C)
Deq Incoming	MNR_CLU$L_DEQIN	Count of unlock requests (incoming) (longword,C)
Deq Outgoing	MNR_CLU$L_DEQOUT	Count of unlock requests (outgoing) (longword,C)

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